US009426722B2

(12) **United States Patent**
Tsuda

(10) **Patent No.: US 9,426,722 B2**
(45) **Date of Patent: Aug. 23, 2016**

(54) **INFORMATION PROCESSING METHOD, INFORMATION PROCESSING DEVICE COMMUNICATION SYSTEM**

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(73) Assignee: **Sony Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 625 days.

(21) Appl. No.: **13/367,628**

(22) Filed: **Feb. 7, 2012**

(65) **Prior Publication Data**

US 2012/0207023 A1 Aug. 16, 2012

(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
H04W 48/06 (2009.01)

(52) **U.S. Cl.**
CPC ***H04W 48/06*** (2013.01)

(58) **Field of Classification Search**
CPC H04W 48/06
USPC 370/235, 329; 455/450
See application file for complete search history.

(56) **References Cited**

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Assistant Examiner — Richard Chang
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(57) **ABSTRACT**

An information processing method includes determining, when a connection request for connecting, via a base station relating to a first communication carrier, a first wireless communication device to a base station relating to a second communication carrier is received from the first wireless communication device, permission or non-permission for the connection request based on connection information on the number of wireless communication devices connected to a base station relating to the connection request, and setting a connection right to be connected to the base station relating to the connection request to the first wireless communication device when permission is determined in the determining.

20 Claims, 32 Drawing Sheets

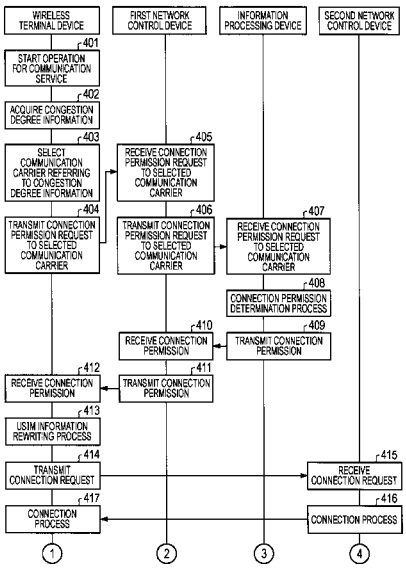


FIG. 1

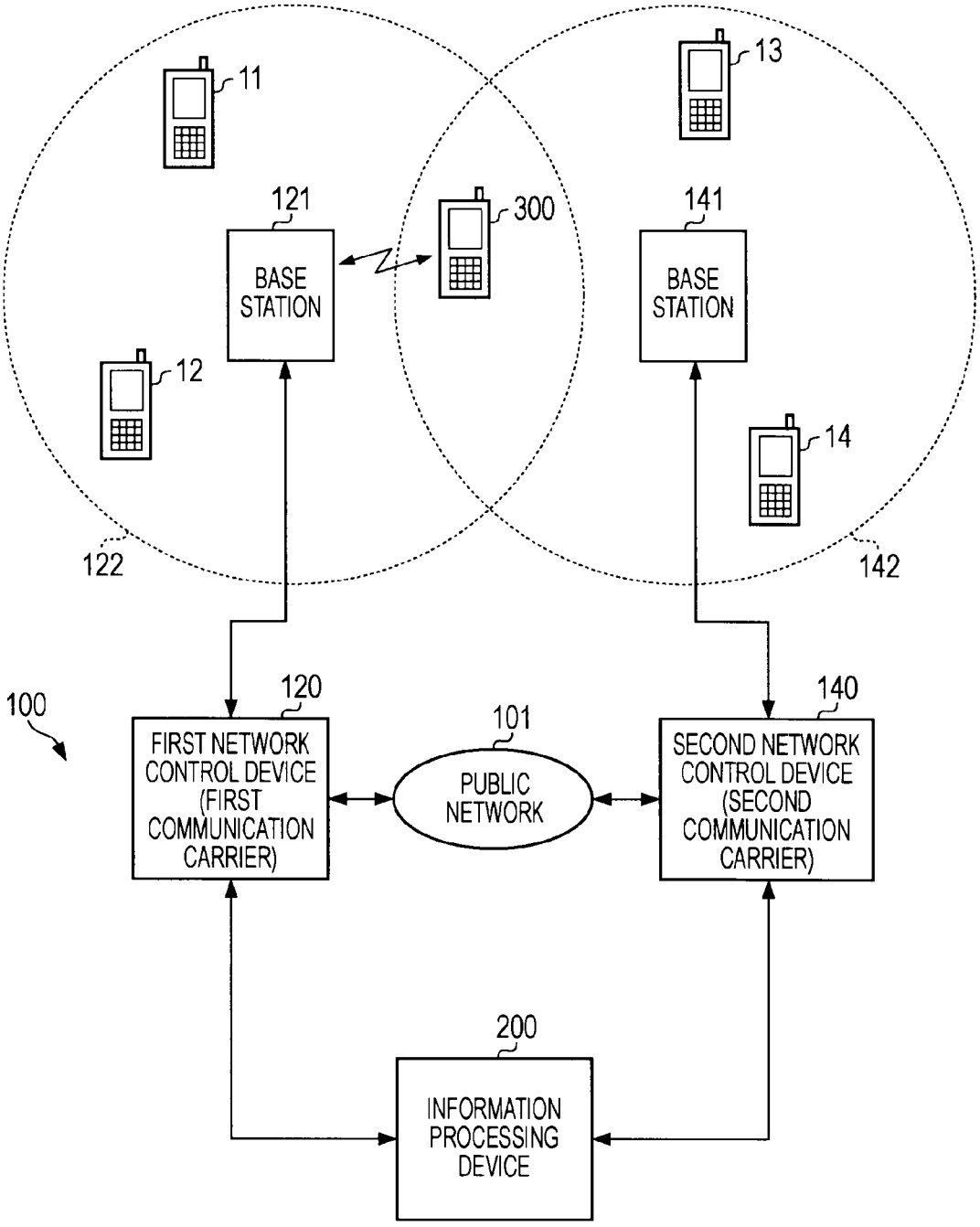

11
13
121
300
141
BASE STATION
BASE STATION
12
14
122
142
100
120
101
140
FIRST NETWORK CONTROL DEVICE (FIRST COMMUNICATION CARRIER)
PUBLIC NETWORK
SECOND NETWORK CONTROL DEVICE (SECOND COMMUNICATION CARRIER)
200
INFORMATION PROCESSING DEVICE

FIG. 2

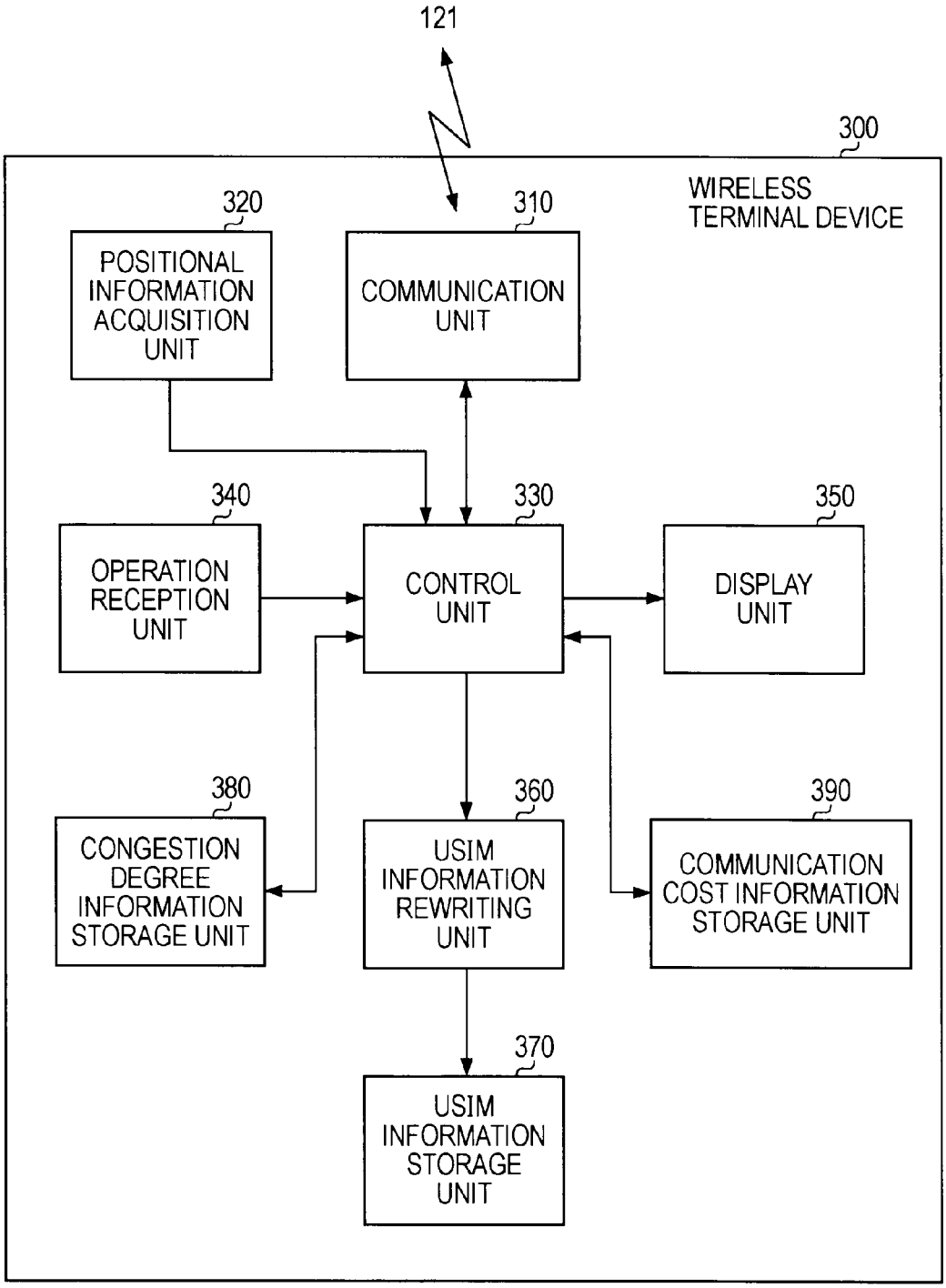

121
300
WIRELESS TERMINAL DEVICE
320
POSITIONAL INFORMATION ACQUISITION UNIT
310
COMMUNICATION UNIT
340
OPERATION RECEPTION UNIT
330
CONTROL UNIT
350
DISPLAY UNIT
380
CONGESTION DEGREE INFORMATION STORAGE UNIT
360
USIM INFORMATION REWRITING UNIT
390
COMMUNICATION COST INFORMATION STORAGE UNIT
370
USIM INFORMATION STORAGE UNIT

FIG. 3

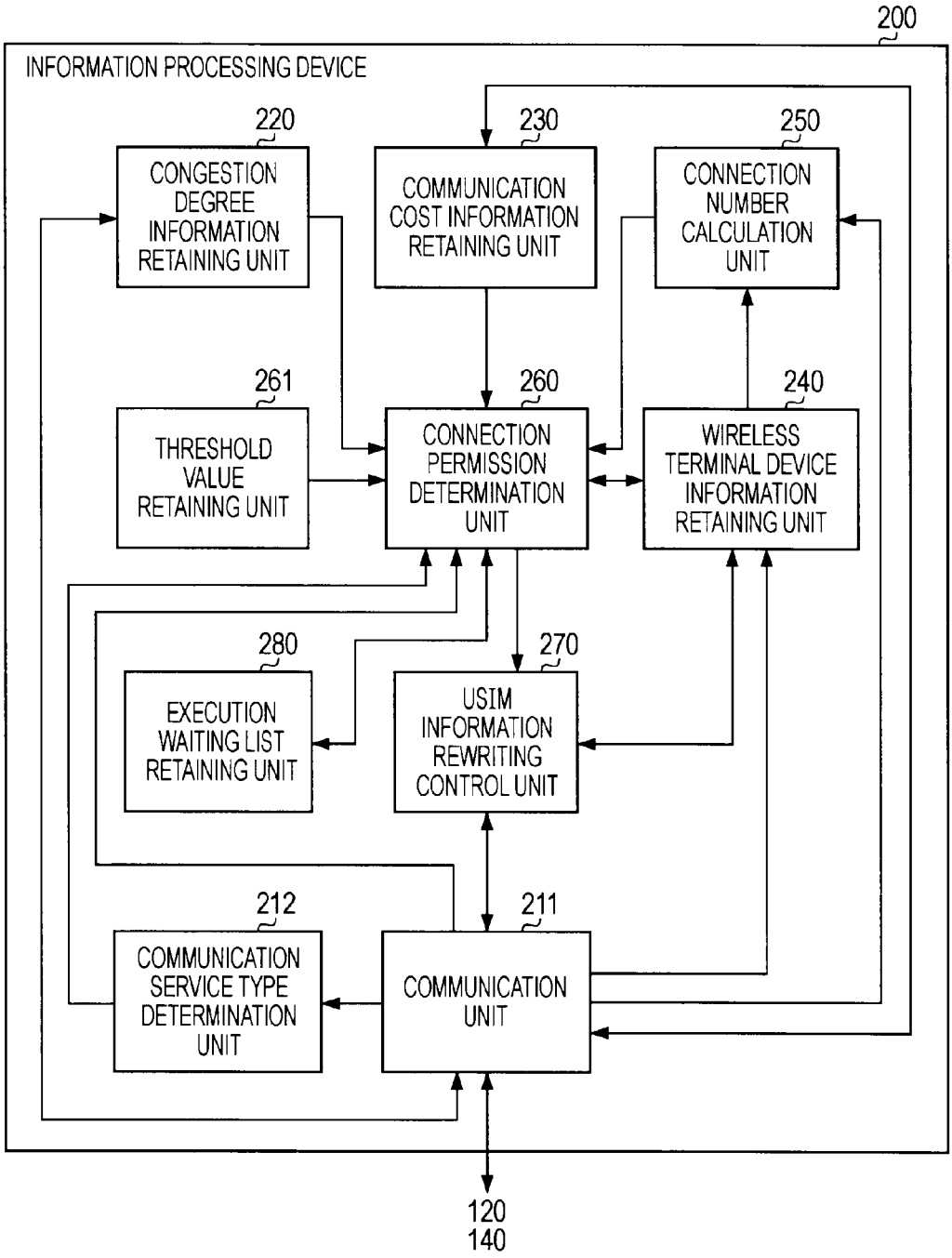

200
INFORMATION PROCESSING DEVICE
220
CONGESTION DEGREE INFORMATION RETAINING UNIT
230
COMMUNICATION COST INFORMATION RETAINING UNIT
250
CONNECTION NUMBER CALCULATION UNIT
261
THRESHOLD VALUE RETAINING UNIT
260
CONNECTION PERMISSION DETERMINATION UNIT
240
WIRELESS TERMINAL DEVICE INFORMATION RETAINING UNIT
280
EXECUTION WAITING LIST RETAINING UNIT
270
USIM INFORMATION REWRITING CONTROL UNIT
212
COMMUNICATION SERVICE TYPE DETERMINATION UNIT
211
COMMUNICATION UNIT
120
140

FIG. 4

220

FIRST COMMUNICATION CARRIER			SECOND COMMUNICATION CARRIER			...
221 CELL ID	222 POSITIONAL INFORMATION	223 CONGESTION DEGREE INFORMATION	221 CELL ID	222 POSITIONAL INFORMATION	223 CONGESTION DEGREE INFORMATION	...
c5c00a	LATITUDE : ○° ○′ LONGITUDE : ○° ○′	0.125	b2640d4	LATITUDE : ○° ○′ LONGITUDE : ○° ○′	0.505	...
611c047	LATITUDE : ○° ○′ LONGITUDE : ○° ○′	0.447	b204066	LATITUDE : ○° ○′ LONGITUDE : ○° ○′	0.111	...
...	...	...	...	...	...	...

FIG. 5

230

THIRD COMMUNICATION CARRIER

SECOND COMMUNICATION CARRIER

FIRST COMMUNICATION CARRIER

231 CELL ID	232 TIME INFORMATION	233 CONGESTION DEGREE INFORMATION	234 COMMUNICATION COST PER PACKET
0001	8:00 – 17:00	0.00 – 0.25	\0.10
		0.25 – 0.75	\0.18
		0.75 – 1.00	\0.25
	17:00 – 1:00	0.00 – 0.25	\0.18
		0.25 – 0.50	\0.23
		0.50 – 0.75	\0.28
		0.75 – 1.00	\0.35
	1:00 – 8:00	0.00 – 0.50	\0.05
		0.50 – 1.00	\0.15
⋮	⋮	⋮	⋮
0077	8:00 – 17:00	0.00 – 0.25	\0.15
		0.25 – 0.75	\0.20
		0.75 – 1.00	\0.28
	⋮	⋮	⋮
⋮	⋮	⋮	⋮
00AF	⋮	⋮	⋮
	1:00 – 8:00	0.00 – 0.50	\0.10
		0.50 – 1.00	\0.25

FIG. 6A

240

241 TERMINAL IDENTIFICATION INFORMATION	242 CELL ID	243 CONNECTION-PERMITTING COMMUNICATION CARRIER
1111 – 0000 – 2222	c5c00a	SECOND COMMUNICATION CARRIER
1111 – 1234 – 5678	b2640d4	FIRST COMMUNICATION CARRIER
⋮	⋮	⋮
1234 – 2222 – 4321	5f2407d	THIRD COMMUNICATION CARRIER

FIG. 6B

245

246 LATITUDE	247 LONGITUDE	248 CELL ID, PILOT SIGNAL INTENSITY		249 CELL ID, INTERFERENCE INDEX	
34.6250	135.0400	a017, -88	a018, -85	a017, 0.099	a018, 0.121
34.6250	135.0405	a017, -89	a018, -86	a017, 0.177	a018, 0.153
⋮	⋮	⋮	⋮	⋮	⋮
34.6255	135.0400	12c1, -70	12c2, -68	12c1, 0.175	12c2, 0.155
34.6255	135.0405	12c1, -69	12c2, -70	12c1, 0.275	12c2, 0.256
⋮	⋮	⋮	⋮	⋮	⋮

FIG. 7A

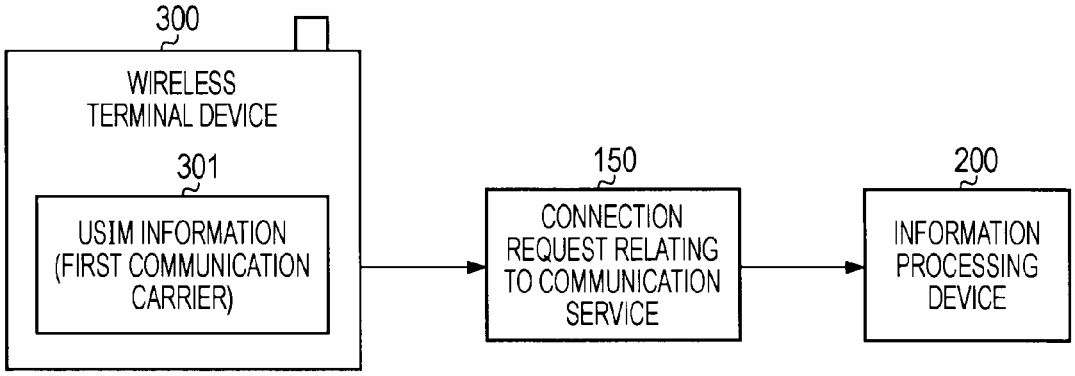

300
WIRELESS TERMINAL DEVICE
301
USIM INFORMATION (FIRST COMMUNICATION CARRIER)
150
CONNECTION REQUEST RELATING TO COMMUNICATION SERVICE
200
INFORMATION PROCESSING DEVICE

FIG. 7B

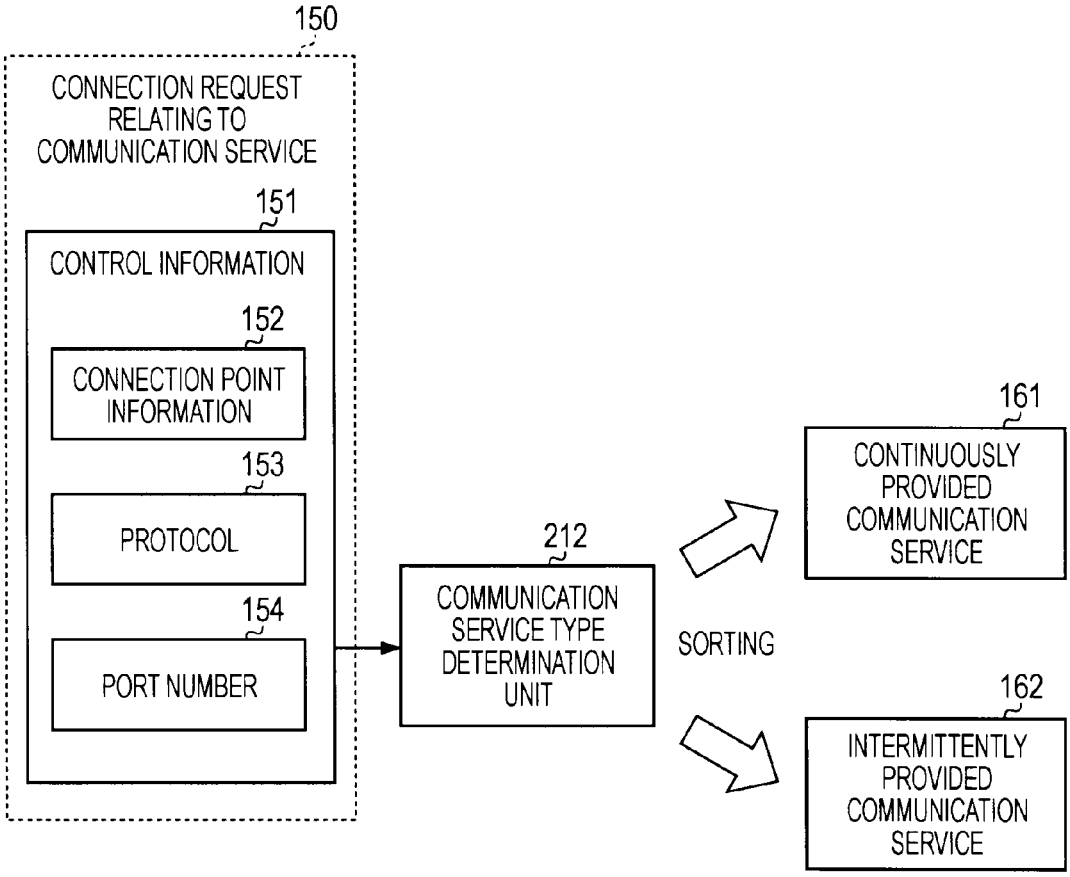

150
CONNECTION REQUEST RELATING TO COMMUNICATION SERVICE
151
CONTROL INFORMATION
152
CONNECTION POINT INFORMATION
153
PROTOCOL
154
PORT NUMBER
212
COMMUNICATION SERVICE TYPE DETERMINATION UNIT
SORTING
161
CONTINUOUSLY PROVIDED COMMUNICATION SERVICE
162
INTERMITTENTLY PROVIDED COMMUNICATION SERVICE

FIG. 8

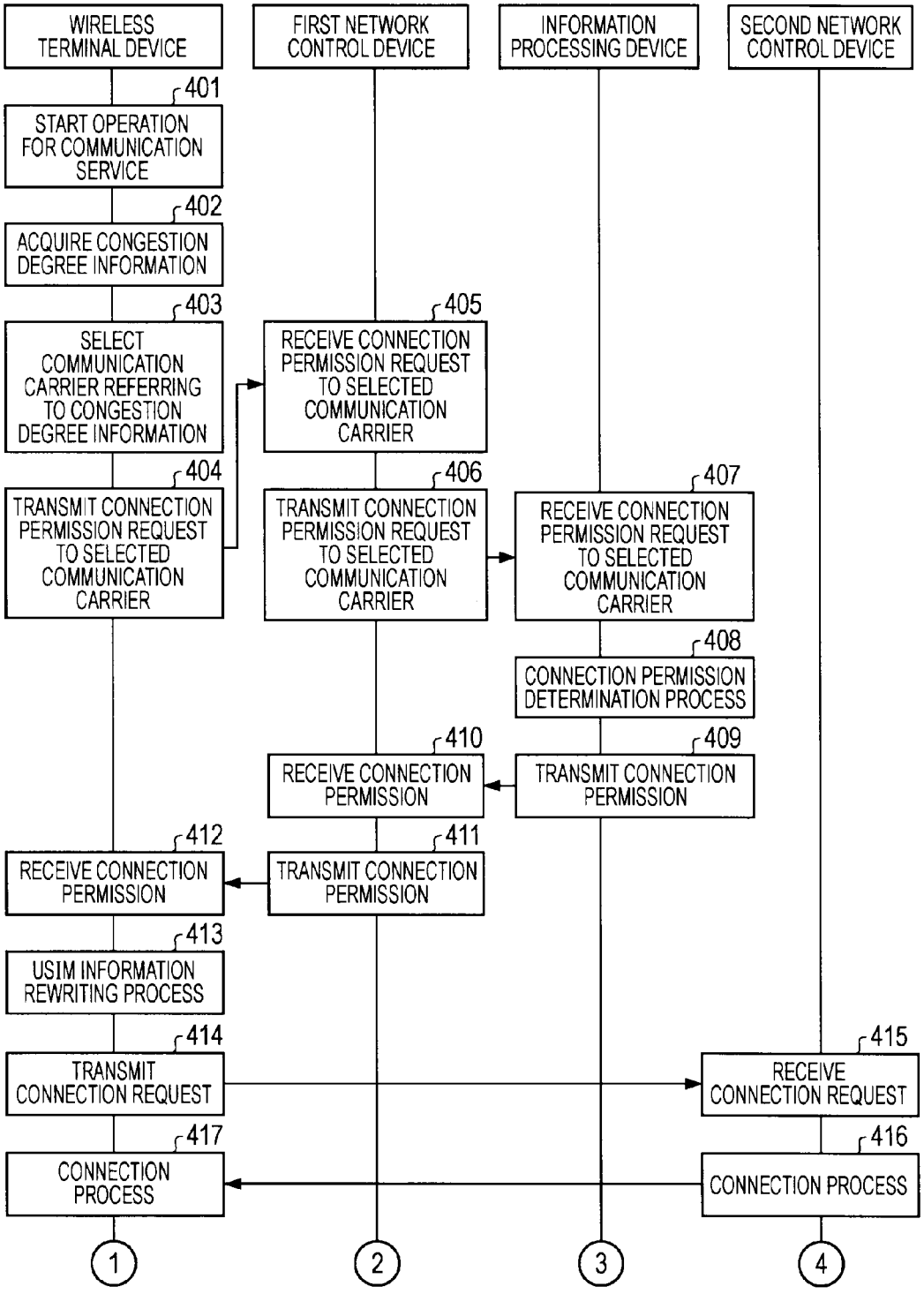

WIRELESS TERMINAL DEVICE
FIRST NETWORK CONTROL DEVICE
INFORMATION PROCESSING DEVICE
SECOND NETWORK CONTROL DEVICE
401
START OPERATION FOR COMMUNICATION SERVICE
402
ACQUIRE CONGESTION DEGREE INFORMATION
403
SELECT COMMUNICATION CARRIER REFERRING TO CONGESTION DEGREE INFORMATION
404
TRANSMIT CONNECTION PERMISSION REQUEST TO SELECTED COMMUNICATION CARRIER
405
RECEIVE CONNECTION PERMISSION REQUEST TO SELECTED COMMUNICATION CARRIER
406
TRANSMIT CONNECTION PERMISSION REQUEST TO SELECTED COMMUNICATION CARRIER
407
RECEIVE CONNECTION PERMISSION REQUEST TO SELECTED COMMUNICATION CARRIER
408
CONNECTION PERMISSION DETERMINATION PROCESS
409
TRANSMIT CONNECTION PERMISSION
410
RECEIVE CONNECTION PERMISSION
411
TRANSMIT CONNECTION PERMISSION
412
RECEIVE CONNECTION PERMISSION
413
USIM INFORMATION REWRITING PROCESS
414
TRANSMIT CONNECTION REQUEST
415
RECEIVE CONNECTION REQUEST
416
CONNECTION PROCESS
417
CONNECTION PROCESS
1
2
3
4

FIG. 9

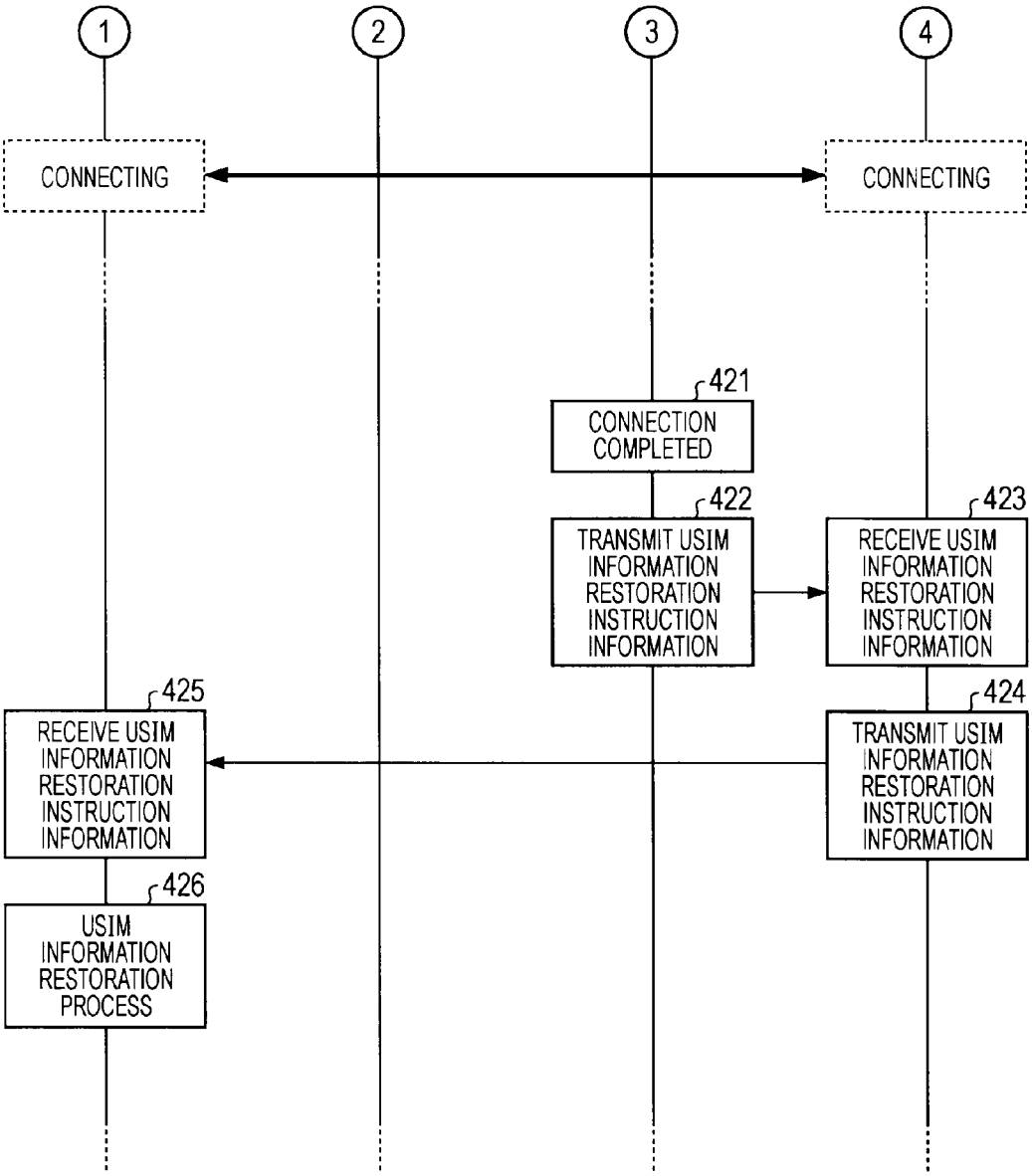

1
2
3
4
CONNECTING
CONNECTING
421
CONNECTION COMPLETED
422
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION
423
RECEIVE USIM INFORMATION RESTORATION INSTRUCTION INFORMATION
424
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION
425
RECEIVE USIM INFORMATION RESTORATION INSTRUCTION INFORMATION
426
USIM INFORMATION RESTORATION PROCESS

FIG. 10A

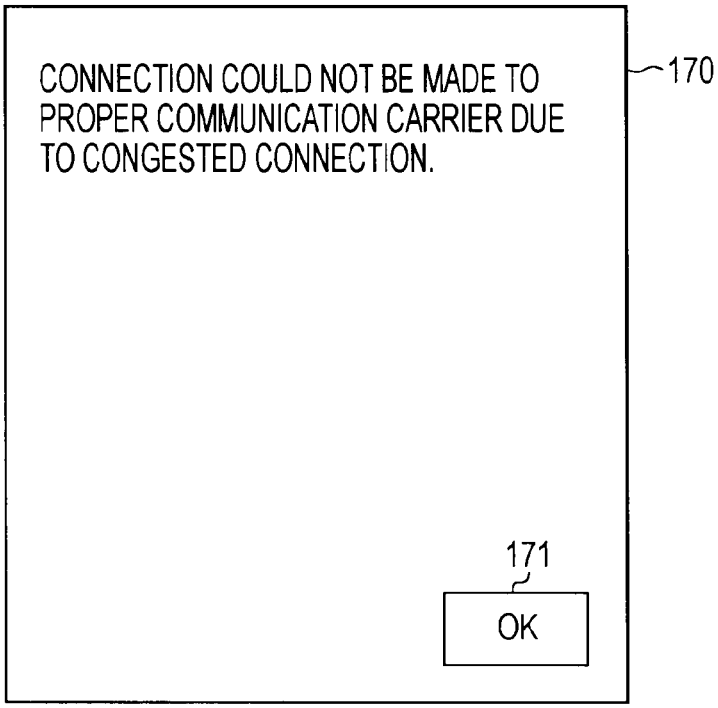


FIG. 10B

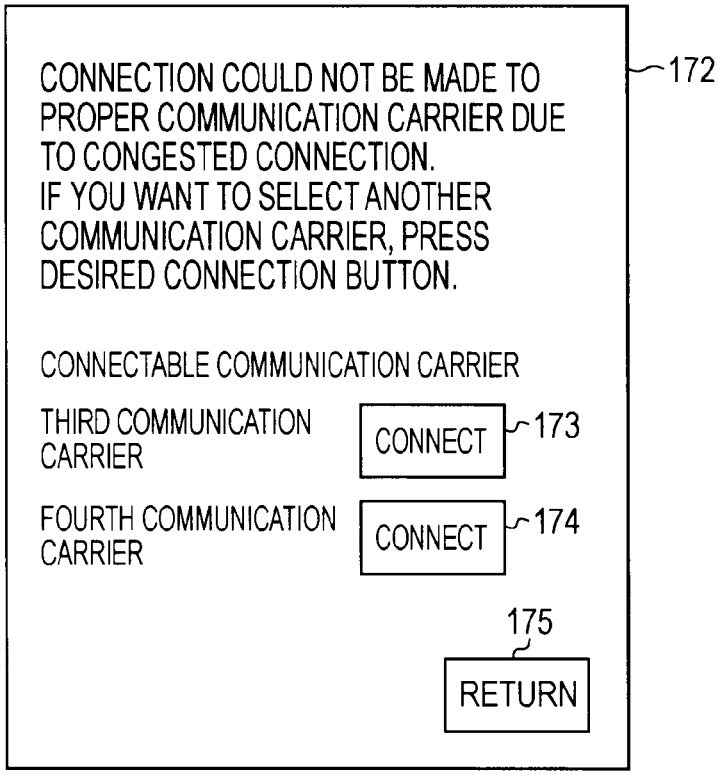


FIG. 11

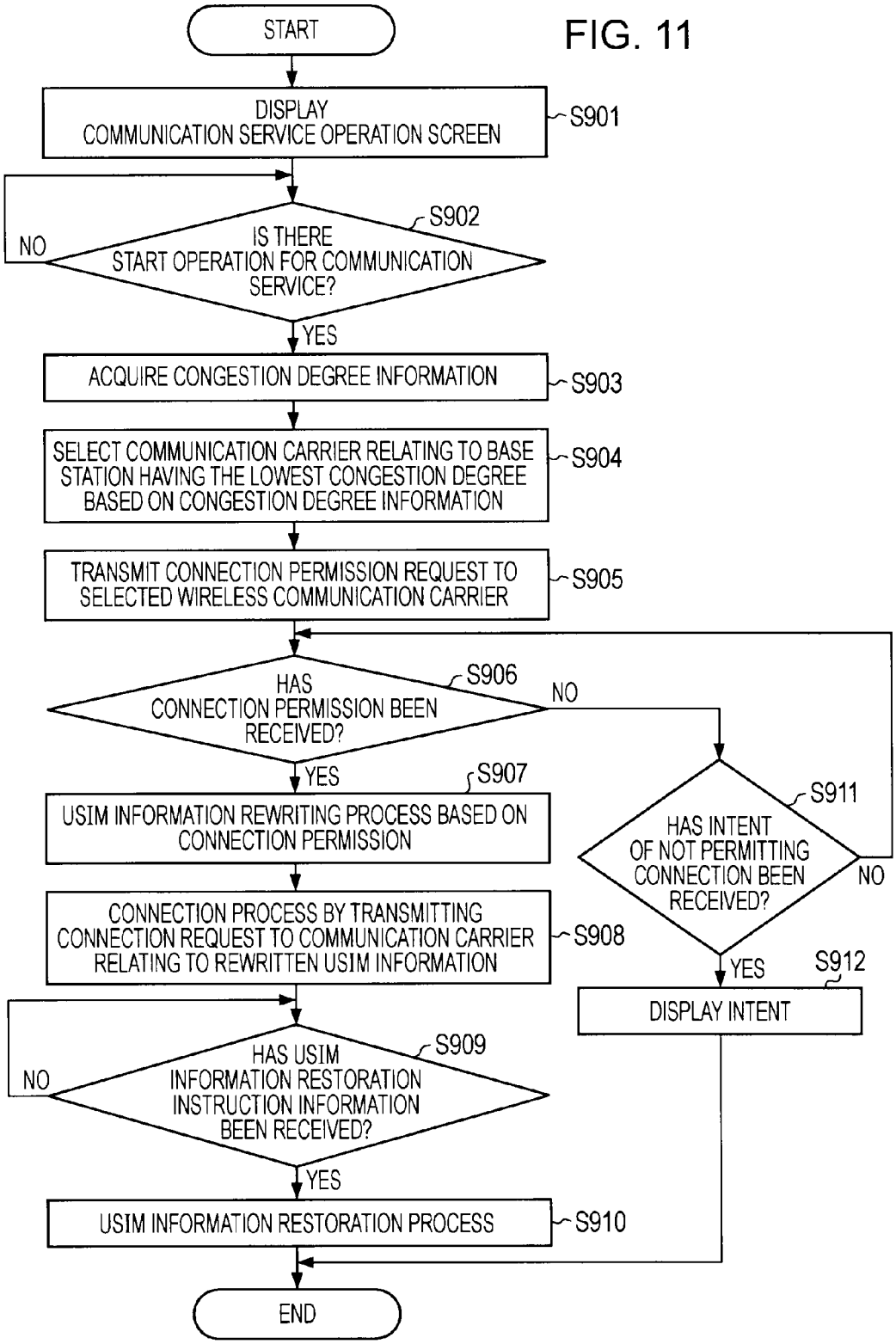

START
DISPLAY COMMUNICATION SERVICE OPERATION SCREEN
S901
IS THERE START OPERATION FOR COMMUNICATION SERVICE?
S902
NO
YES
ACQUIRE CONGESTION DEGREE INFORMATION
S903
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION HAVING THE LOWEST CONGESTION DEGREE BASED ON CONGESTION DEGREE INFORMATION
S904
TRANSMIT CONNECTION PERMISSION REQUEST TO SELECTED WIRELESS COMMUNICATION CARRIER
S905
HAS CONNECTION PERMISSION BEEN RECEIVED?
S906
NO
YES
USIM INFORMATION REWRITING PROCESS BASED ON CONNECTION PERMISSION
S907
CONNECTION PROCESS BY TRANSMITTING CONNECTION REQUEST TO COMMUNICATION CARRIER RELATING TO REWRITTEN USIM INFORMATION
S908
HAS USIM INFORMATION RESTORATION INSTRUCTION INFORMATION BEEN RECEIVED?
S909
NO
YES
USIM INFORMATION RESTORATION PROCESS
S910
HAS INTENT OF NOT PERMITTING CONNECTION BEEN RECEIVED?
S911
NO
YES
DISPLAY INTENT
S912
END

FIG. 12

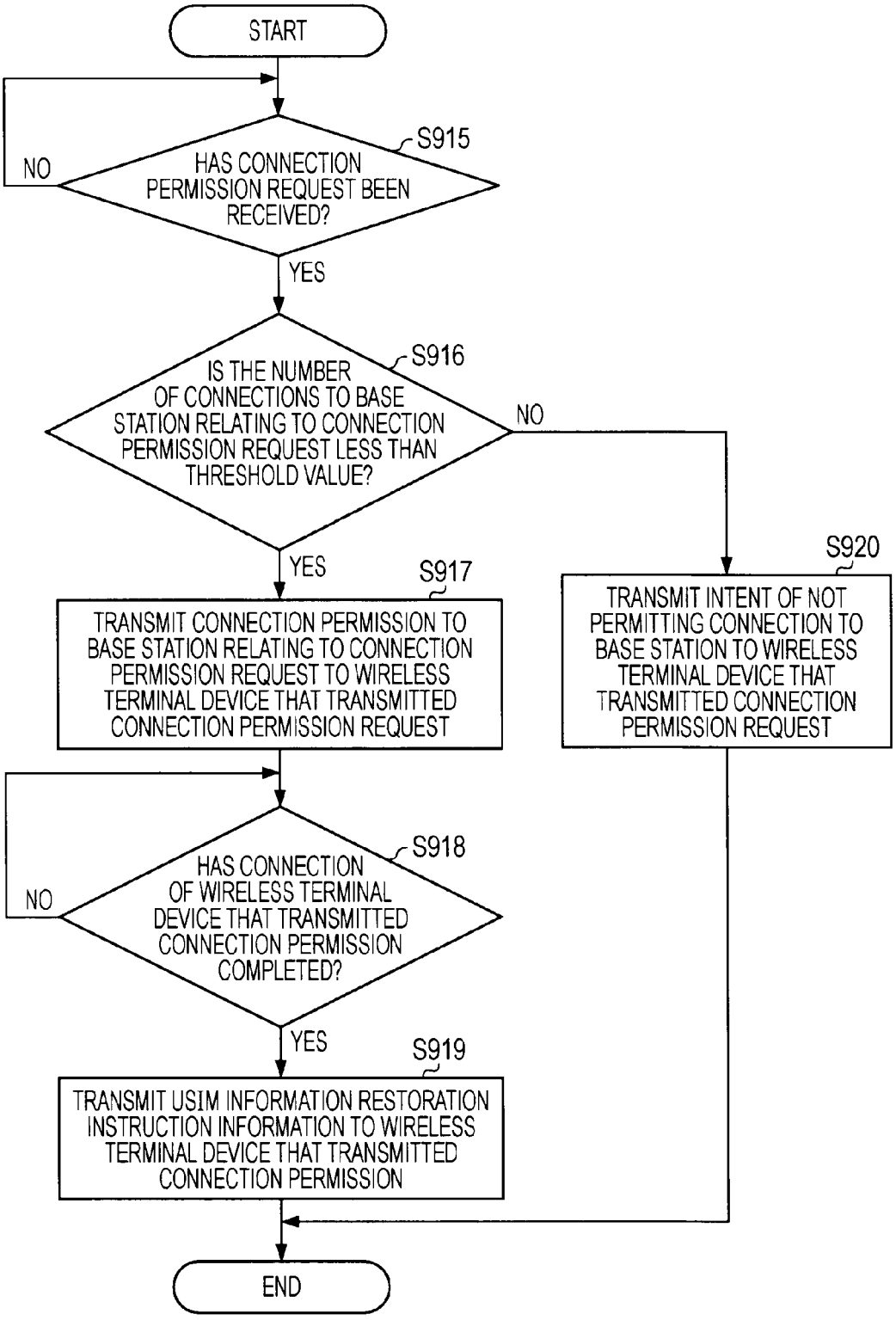

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S916
IS THE NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S920
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
END

FIG. 13

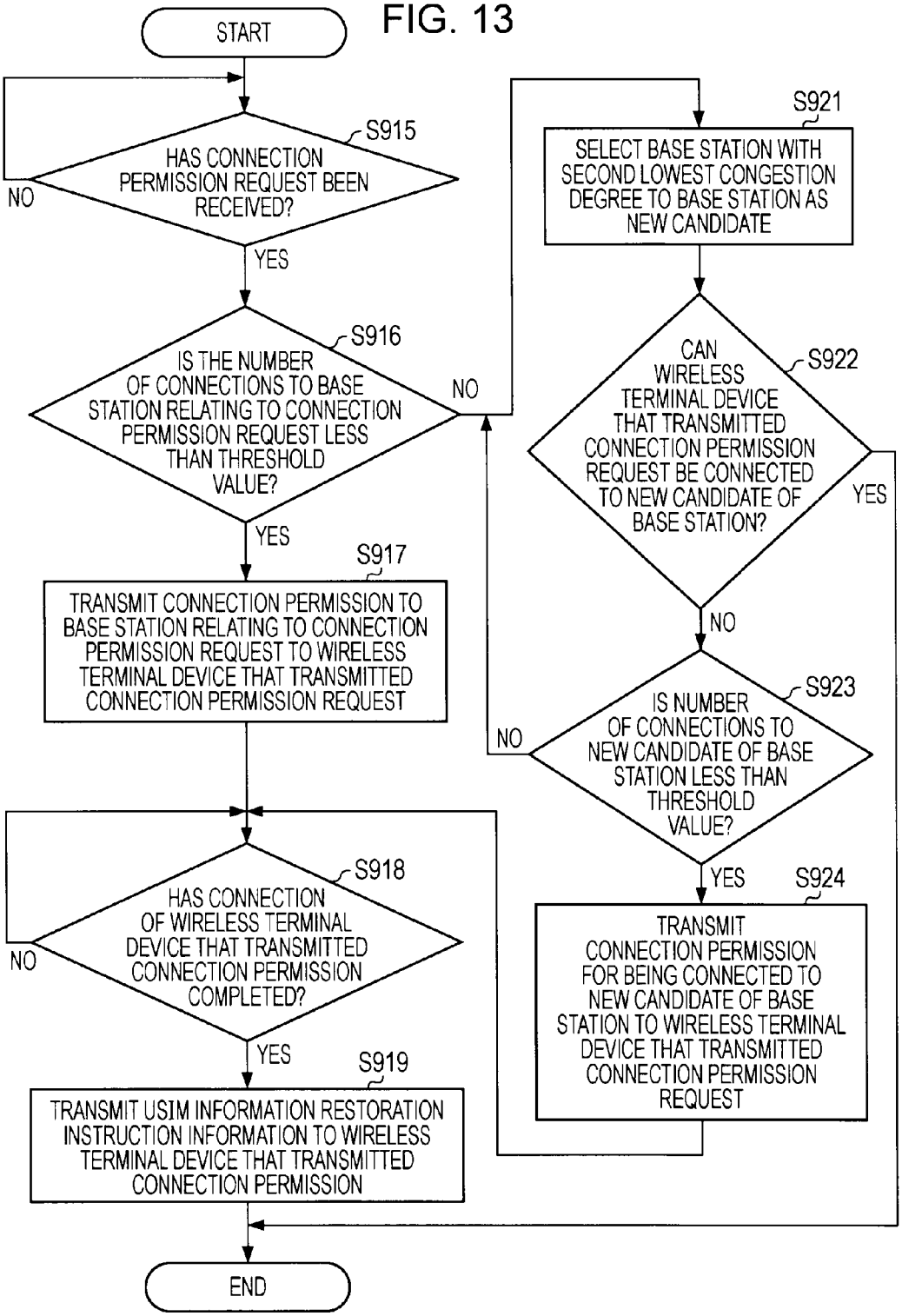

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S916
IS THE NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
END
S921
SELECT BASE STATION WITH SECOND LOWEST CONGESTION DEGREE TO BASE STATION AS NEW CANDIDATE
S922
CAN WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST BE CONNECTED TO NEW CANDIDATE OF BASE STATION?
YES
NO
S923
IS NUMBER OF CONNECTIONS TO NEW CANDIDATE OF BASE STATION LESS THAN THRESHOLD VALUE?
NO
YES
S924
TRANSMIT CONNECTION PERMISSION FOR BEING CONNECTED TO NEW CANDIDATE OF BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST

FIG. 14

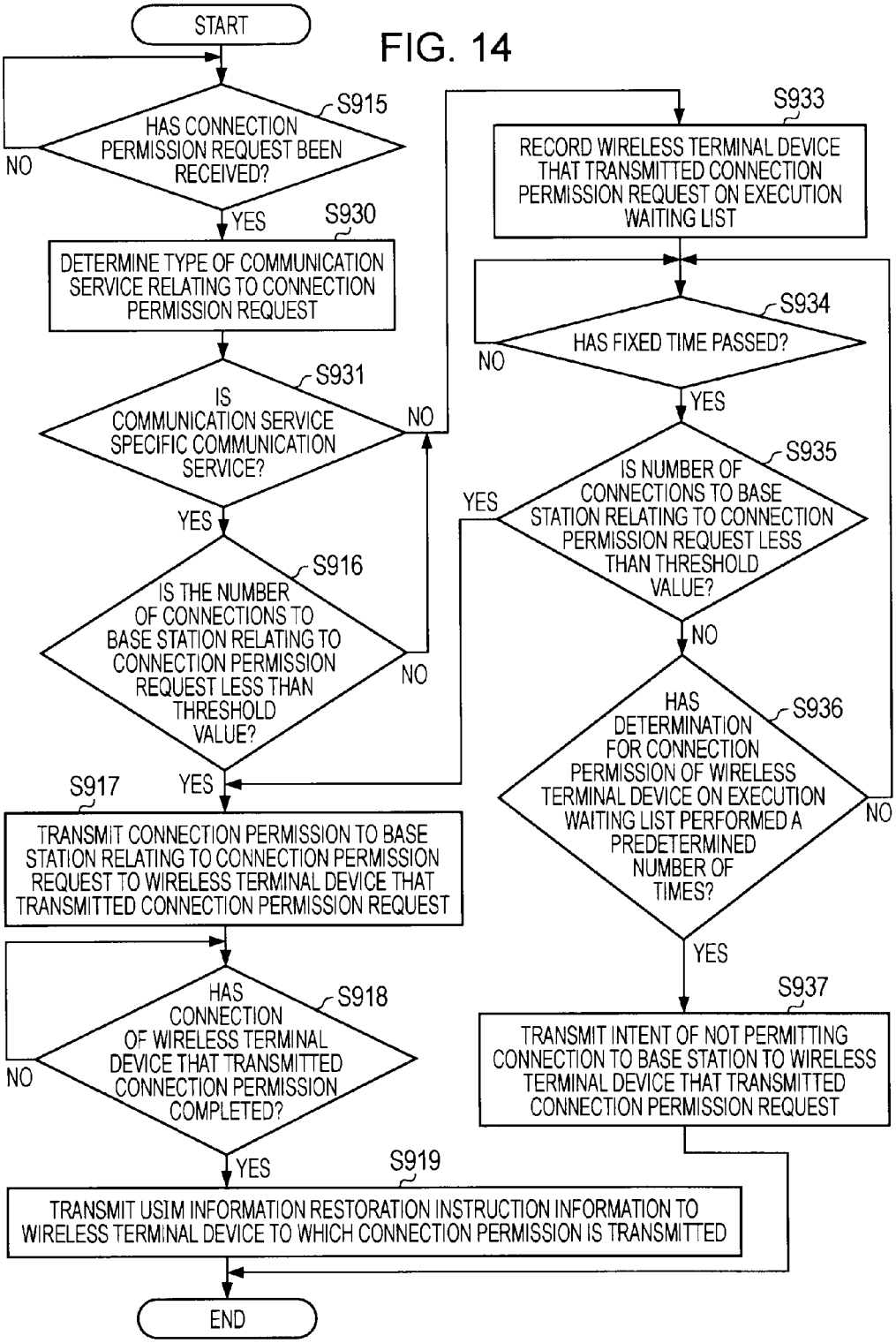

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S930
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S931
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
NO
YES
S916
IS THE NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
END
S933
RECORD WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST ON EXECUTION WAITING LIST
S934
HAS FIXED TIME PASSED?
NO
YES
S935
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
YES
NO
S936
HAS DETERMINATION FOR CONNECTION PERMISSION OF WIRELESS TERMINAL DEVICE ON EXECUTION WAITING LIST PERFORMED A PREDETERMINED NUMBER OF TIMES?
NO
YES
S937
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST

FIG. 15

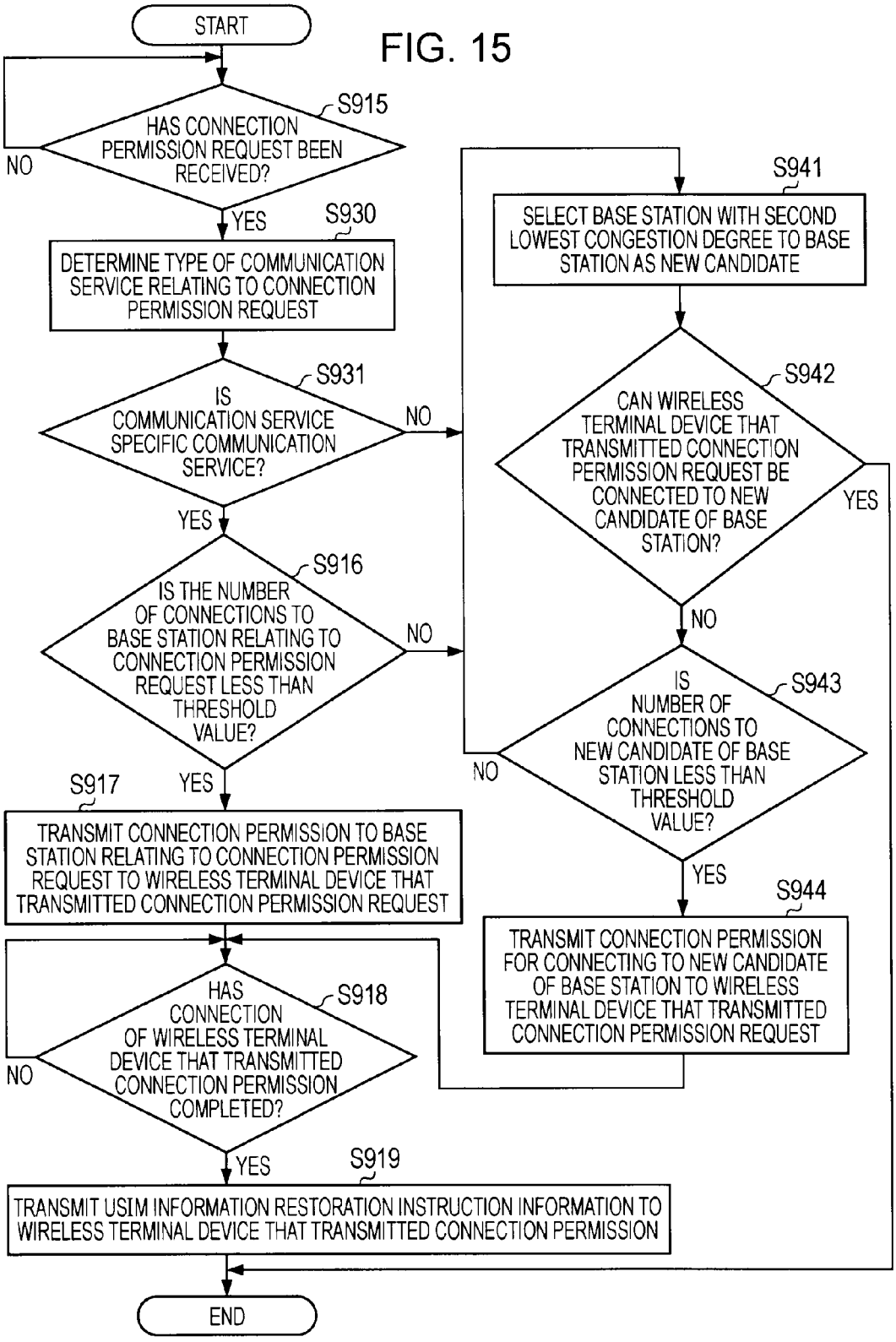

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S930
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S931
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
NO
YES
S916
IS THE NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
END
S941
SELECT BASE STATION WITH SECOND LOWEST CONGESTION DEGREE TO BASE STATION AS NEW CANDIDATE
S942
CAN WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST BE CONNECTED TO NEW CANDIDATE OF BASE STATION?
YES
NO
S943
IS NUMBER OF CONNECTIONS TO NEW CANDIDATE OF BASE STATION LESS THAN THRESHOLD VALUE?
NO
YES
S944
TRANSMIT CONNECTION PERMISSION FOR CONNECTING TO NEW CANDIDATE OF BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST

FIG. 16A

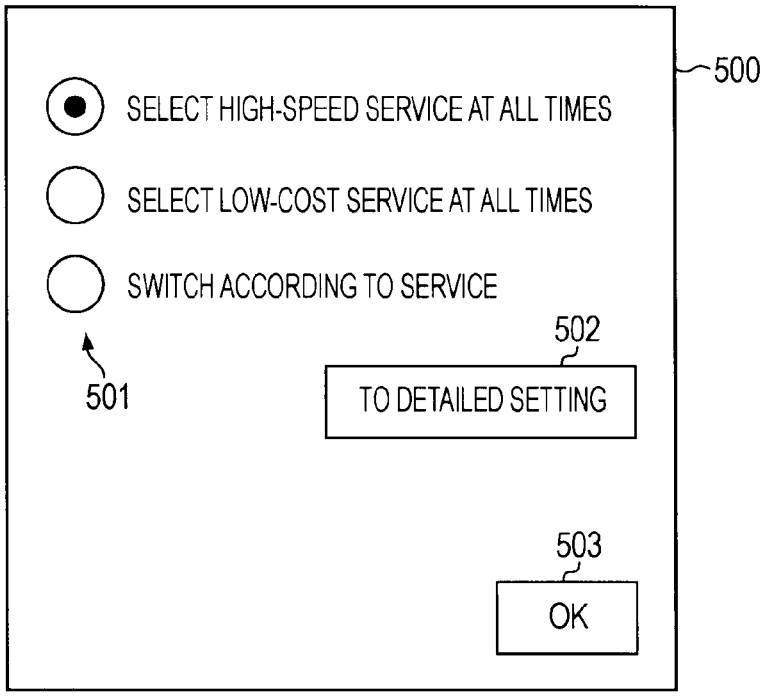


FIG. 16B

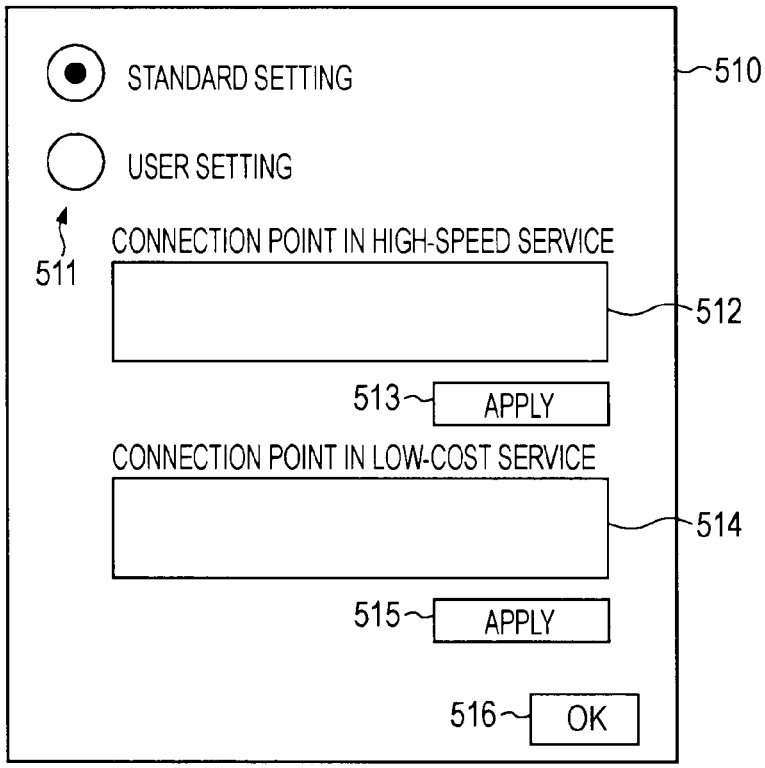


FIG. 17

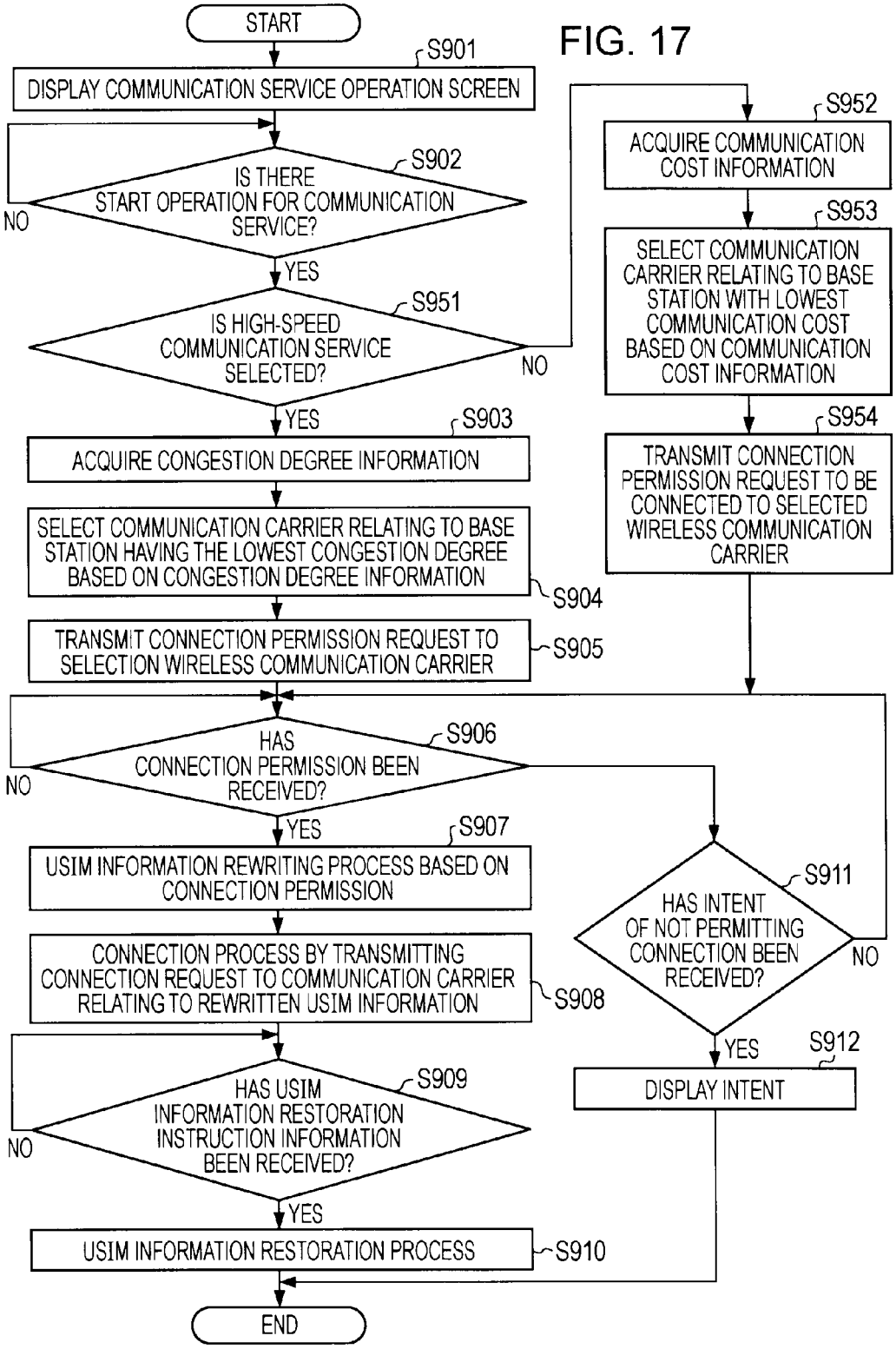

START
S901
DISPLAY COMMUNICATION SERVICE OPERATION SCREEN
S902
IS THERE START OPERATION FOR COMMUNICATION SERVICE?
NO
YES
S951
IS HIGH-SPEED COMMUNICATION SERVICE SELECTED?
NO
YES
S903
ACQUIRE CONGESTION DEGREE INFORMATION
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION HAVING THE LOWEST CONGESTION DEGREE BASED ON CONGESTION DEGREE INFORMATION
S904
TRANSMIT CONNECTION PERMISSION REQUEST TO SELECTION WIRELESS COMMUNICATION CARRIER
S905
S952
ACQUIRE COMMUNICATION COST INFORMATION
S953
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION WITH LOWEST COMMUNICATION COST BASED ON COMMUNICATION COST INFORMATION
S954
TRANSMIT CONNECTION PERMISSION REQUEST TO BE CONNECTED TO SELECTED WIRELESS COMMUNICATION CARRIER
S906
HAS CONNECTION PERMISSION BEEN RECEIVED?
NO
YES
S907
USIM INFORMATION REWRITING PROCESS BASED ON CONNECTION PERMISSION
CONNECTION PROCESS BY TRANSMITTING CONNECTION REQUEST TO COMMUNICATION CARRIER RELATING TO REWRITTEN USIM INFORMATION
S908
S911
HAS INTENT OF NOT PERMITTING CONNECTION BEEN RECEIVED?
NO
YES
S912
DISPLAY INTENT
S909
HAS USIM INFORMATION RESTORATION INSTRUCTION INFORMATION BEEN RECEIVED?
NO
YES
USIM INFORMATION RESTORATION PROCESS
S910
END

FIG. 18

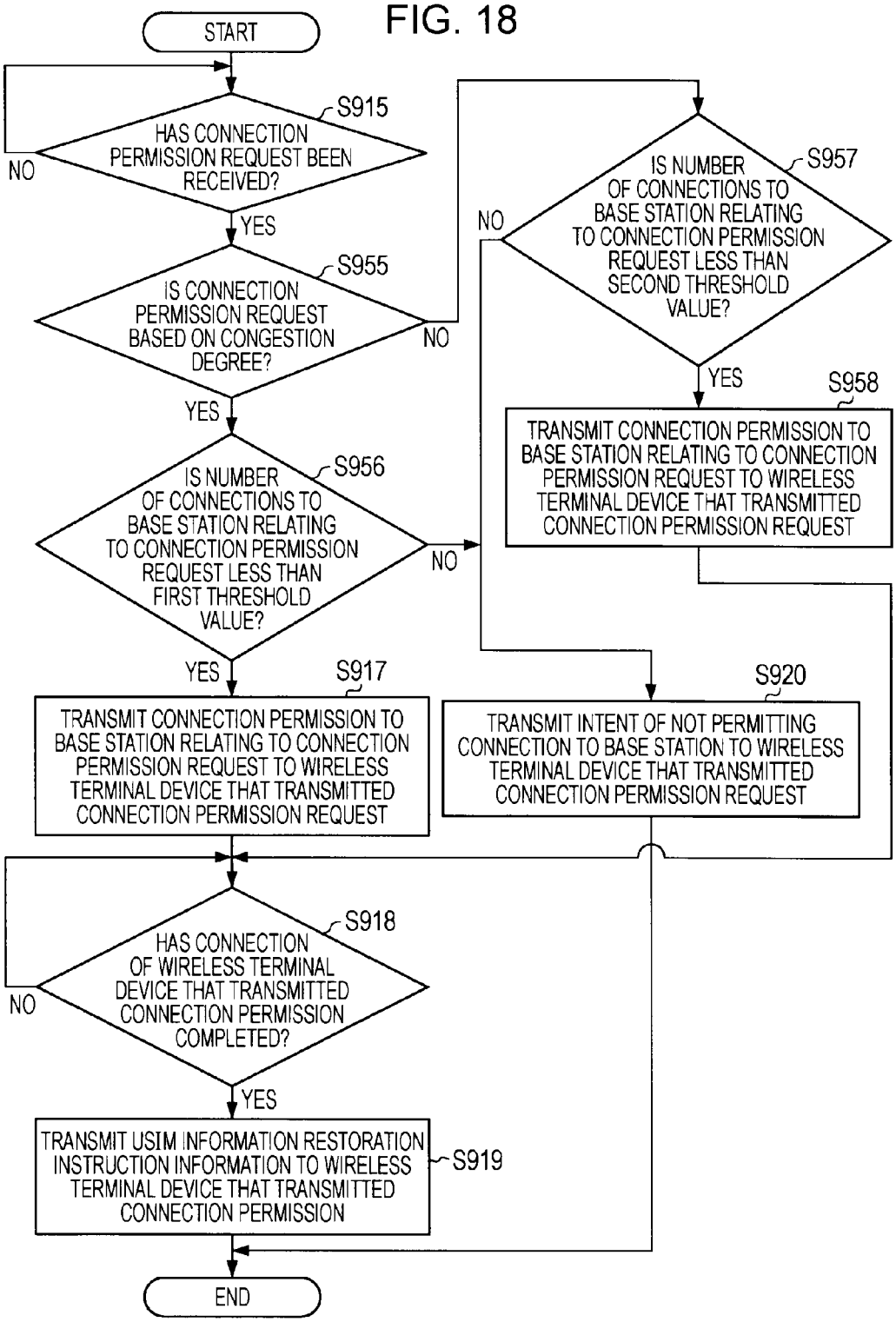

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S955
IS CONNECTION PERMISSION REQUEST BASED ON CONGESTION DEGREE?
NO
YES
S956
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN FIRST THRESHOLD VALUE?
NO
YES
S957
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN SECOND THRESHOLD VALUE?
NO
YES
S958
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S920
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
END

FIG. 19

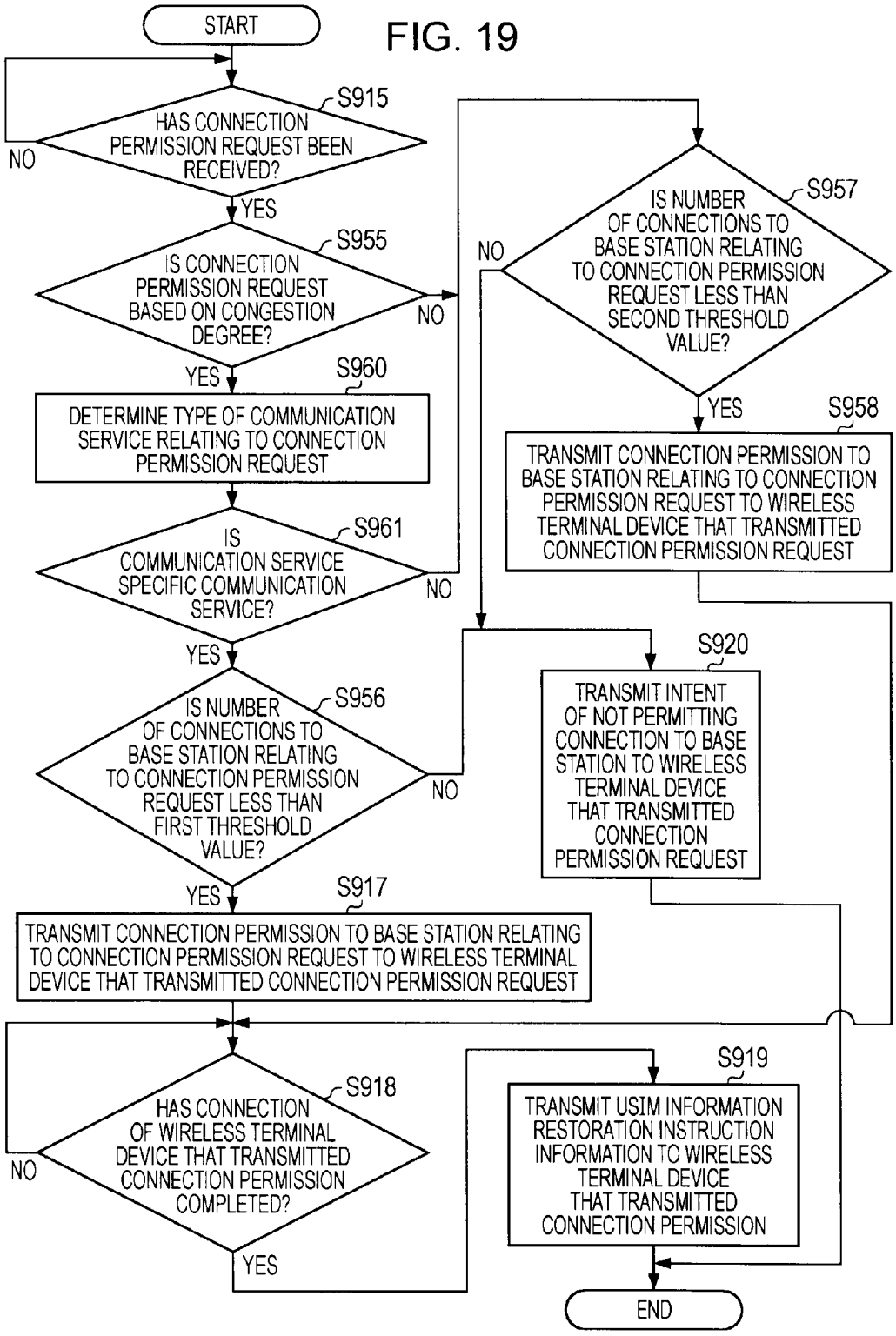

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S955
IS CONNECTION PERMISSION REQUEST BASED ON CONGESTION DEGREE?
NO
YES
S960
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S961
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
NO
YES
S956
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN FIRST THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S957
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN SECOND THRESHOLD VALUE?
NO
YES
S958
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S920
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
END

FIG. 20

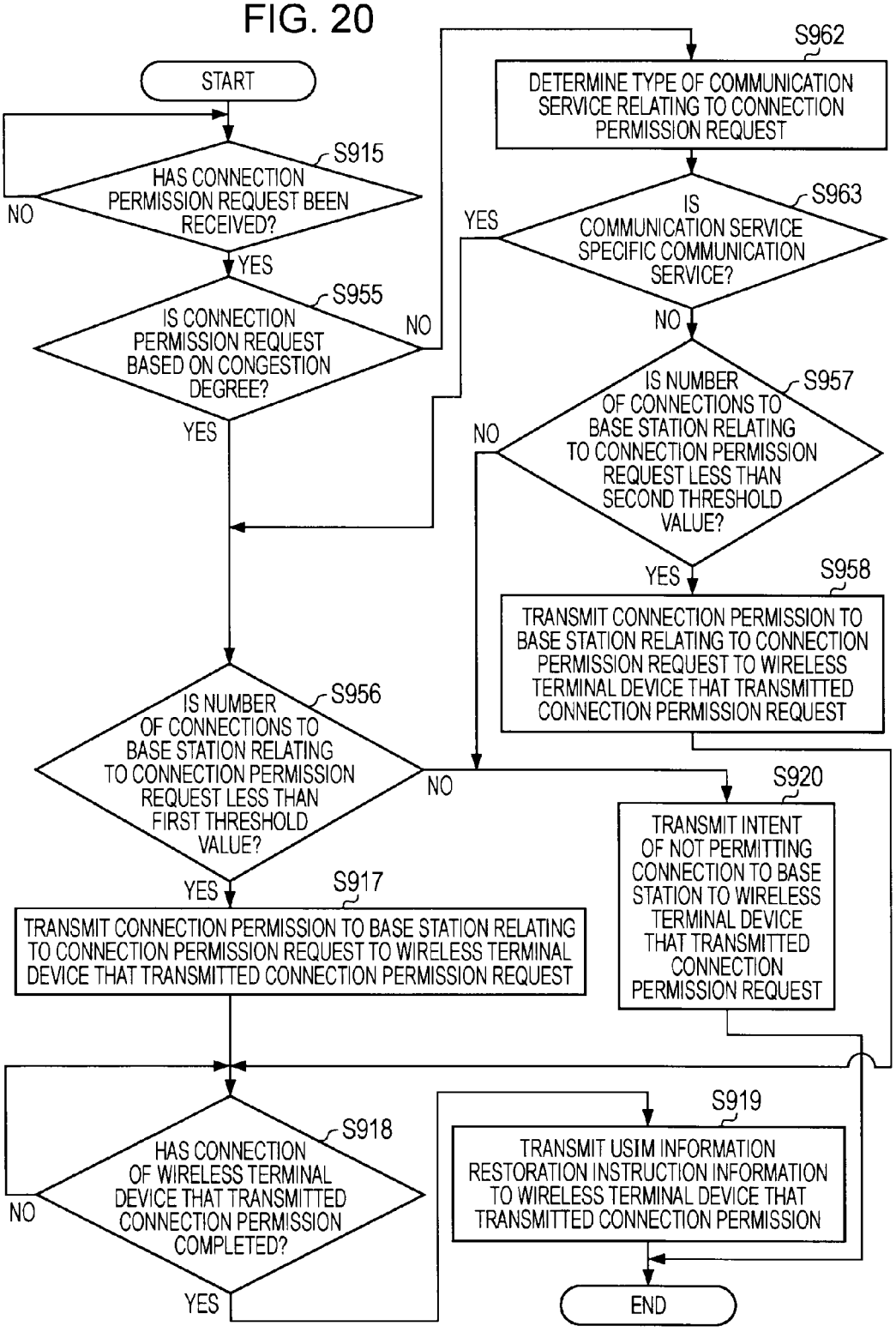

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S955
IS CONNECTION PERMISSION REQUEST BASED ON CONGESTION DEGREE?
NO
YES
S956
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN FIRST THRESHOLD VALUE?
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S962
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S963
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
YES
NO
S957
IS NUMBER OF CONNECTIONS TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN SECOND THRESHOLD VALUE?
NO
YES
S958
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
NO
S920
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
END

FIG. 21A

551 APPLICATION LEVEL	552 TYPE OF COMMUNICATION SERVICE (TYPE OF APPLICATION)	553 LIMITED PROTOCOL/PORT
L1	E-MAIL TRANSMISSION AND RECEPTION VIEWING TEXT ON THE INTERNET VoIP	POP3 TCP/995 HTTPSTCP/443
L2	VIEWING STILL IMAGE ON THE INTERNET DOWNLOADING IMAGE FILE	HTTPS TCP/443
L3	FLASH MOVING IMAGE VIEWING THE INTERNET INCLUDING MOVING IMAGE DOWNLOADING MOVING IMAGE FILE	HTTPS TCP/443 TELNET TCP/23 FTPS TCP/989, 990

FIG. 21B

561 CONGESTION DEGREE k_{cong}	562 PERMITTED APPLICATION LEVEL
$0.9 < k_{cong} \leq 1.0$	L1
$0.8 < k_{cong} \leq 0.9$	L1
$0.7 < k_{cong} \leq 0.8$	L1
$0.6 < k_{cong} \leq 0.7$	L1, L2
$0.5 < k_{cong} \leq 0.6$	L1, L2
$0.4 < k_{cong} \leq 0.5$	L1, L2
$0.3 < k_{cong} \leq 0.4$	L1, L2, L3
$0.2 < k_{cong} \leq 0.3$	L1, L2, L3
$0.1 < k_{cong} \leq 0.2$	L1, L2, L3
$k_{cong} \leq 0.1$	L1, L2, L3

FIG. 22

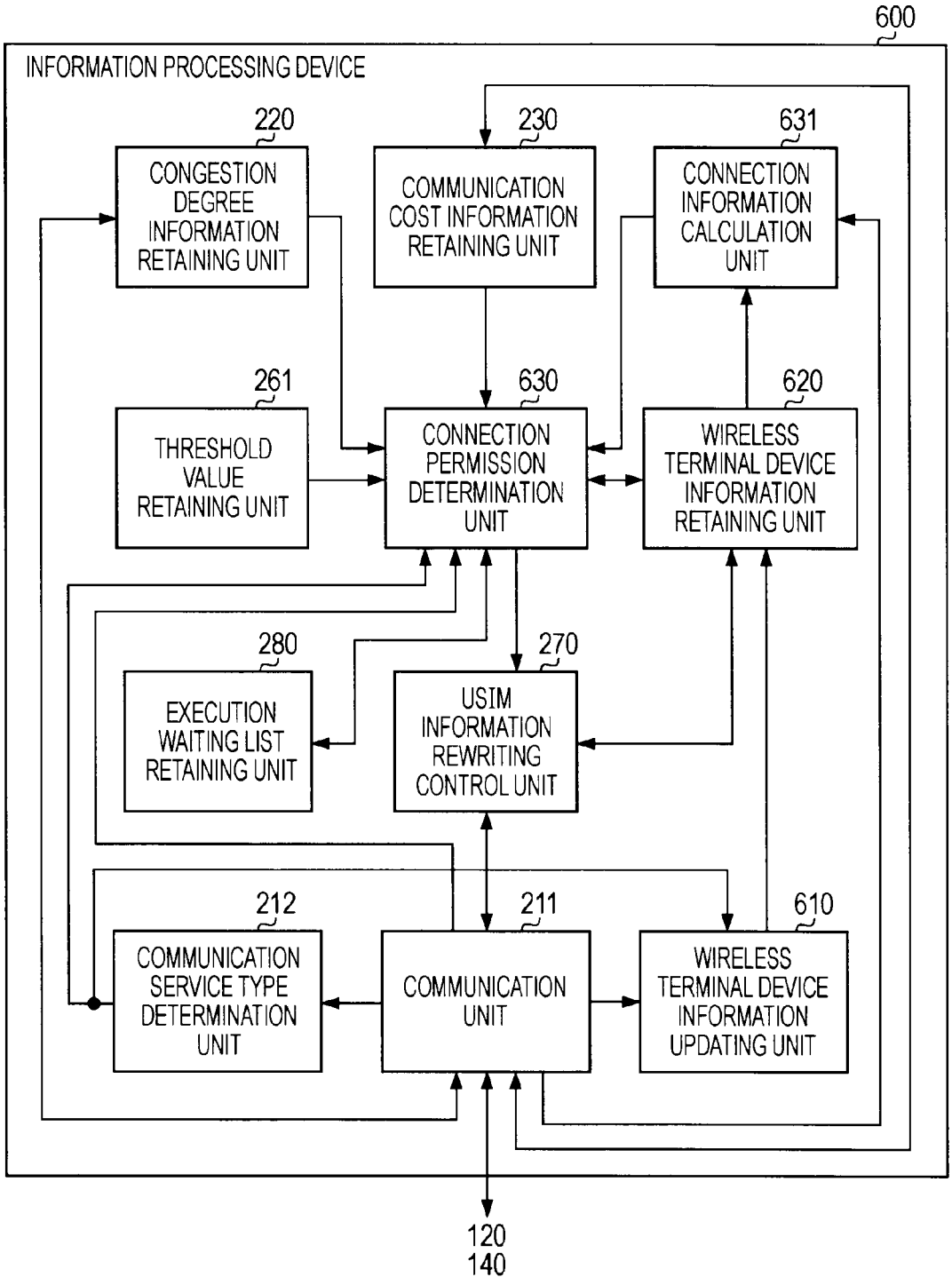

600
INFORMATION PROCESSING DEVICE
220
CONGESTION DEGREE INFORMATION RETAINING UNIT
230
COMMUNICATION COST INFORMATION RETAINING UNIT
631
CONNECTION INFORMATION CALCULATION UNIT
261
THRESHOLD VALUE RETAINING UNIT
630
CONNECTION PERMISSION DETERMINATION UNIT
620
WIRELESS TERMINAL DEVICE INFORMATION RETAINING UNIT
280
EXECUTION WAITING LIST RETAINING UNIT
270
USIM INFORMATION REWRITING CONTROL UNIT
212
COMMUNICATION SERVICE TYPE DETERMINATION UNIT
211
COMMUNICATION UNIT
610
WIRELESS TERMINAL DEVICE INFORMATION UPDATING UNIT
120
140

FIG. 23

620

621 TERMINAL IDENTIFICATION INFORMATION	622 CELL ID	623 CONNECTION PERMITTING COMMUNICATION CARRIER	624 SERVICE TYPE	625 CONGESTION DEGREE FLAG	626 COMMUNICATION COST FLAG	627 WEIGHTED COEFFICIENT	628 CONNECTION POINT CHANGE CANDIDATE
1111-0000-2222	c5c00a	SECOND COMMUNICATION CARRIER	C1	1	0	1.25	1
1111-1234-5678	b2640d4	FIRST COMMUNICATION CARRIER	C1	1	0	0.85	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1234-2222-4321	5f2407d	THIRD COMMUNICATION CARRIER	I1	0	1	0.77	1

FIG. 24

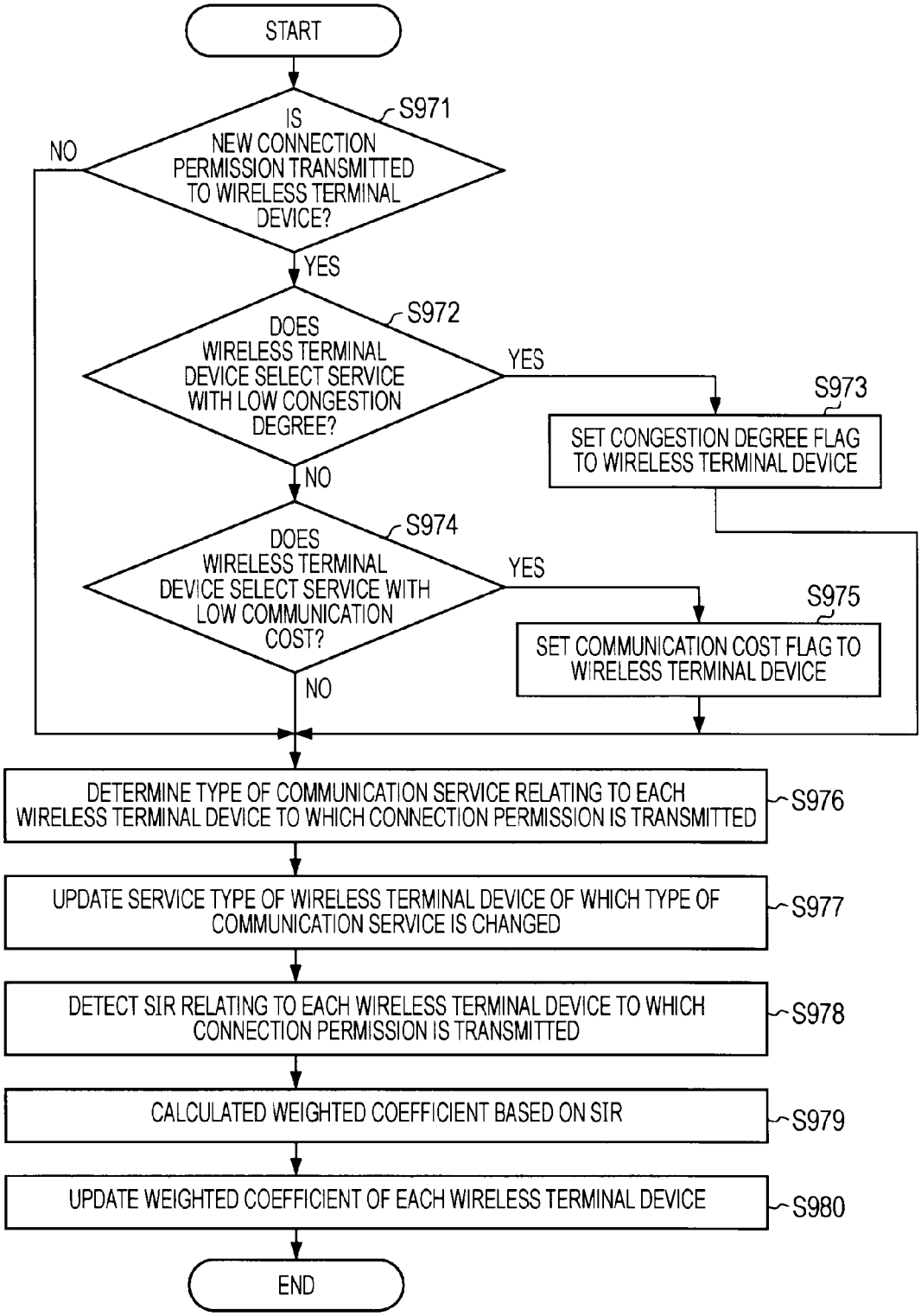

START
S971
IS NEW CONNECTION PERMISSION TRANSMITTED TO WIRELESS TERMINAL DEVICE?
NO
YES
S972
DOES WIRELESS TERMINAL DEVICE SELECT SERVICE WITH LOW CONGESTION DEGREE?
YES
S973
SET CONGESTION DEGREE FLAG TO WIRELESS TERMINAL DEVICE
NO
S974
DOES WIRELESS TERMINAL DEVICE SELECT SERVICE WITH LOW COMMUNICATION COST?
YES
S975
SET COMMUNICATION COST FLAG TO WIRELESS TERMINAL DEVICE
NO
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO EACH WIRELESS TERMINAL DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
S976
UPDATE SERVICE TYPE OF WIRELESS TERMINAL DEVICE OF WHICH TYPE OF COMMUNICATION SERVICE IS CHANGED
S977
DETECT SIR RELATING TO EACH WIRELESS TERMINAL DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
S978
CALCULATED WEIGHTED COEFFICIENT BASED ON SIR
S979
UPDATE WEIGHTED COEFFICIENT OF EACH WIRELESS TERMINAL DEVICE
S980
END

FIG. 25

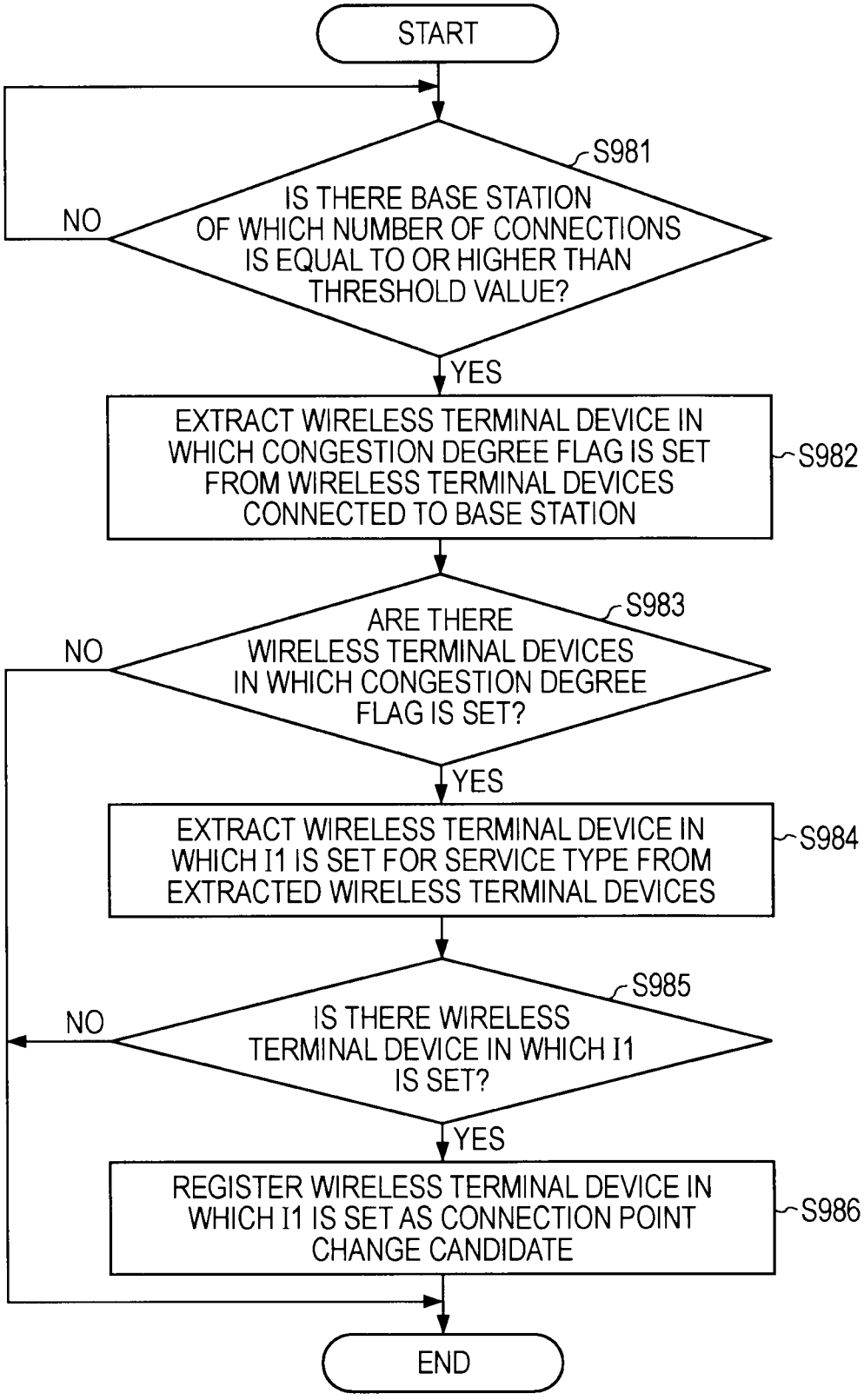

START
S981
IS THERE BASE STATION OF WHICH NUMBER OF CONNECTIONS IS EQUAL TO OR HIGHER THAN THRESHOLD VALUE?
NO
YES
EXTRACT WIRELESS TERMINAL DEVICE IN WHICH CONGESTION DEGREE FLAG IS SET FROM WIRELESS TERMINAL DEVICES CONNECTED TO BASE STATION
S982
S983
ARE THERE WIRELESS TERMINAL DEVICES IN WHICH CONGESTION DEGREE FLAG IS SET?
NO
YES
EXTRACT WIRELESS TERMINAL DEVICE IN WHICH I1 IS SET FOR SERVICE TYPE FROM EXTRACTED WIRELESS TERMINAL DEVICES
S984
S985
IS THERE WIRELESS TERMINAL DEVICE IN WHICH I1 IS SET?
NO
YES
REGISTER WIRELESS TERMINAL DEVICE IN WHICH I1 IS SET AS CONNECTION POINT CHANGE CANDIDATE
S986
END

FIG. 26

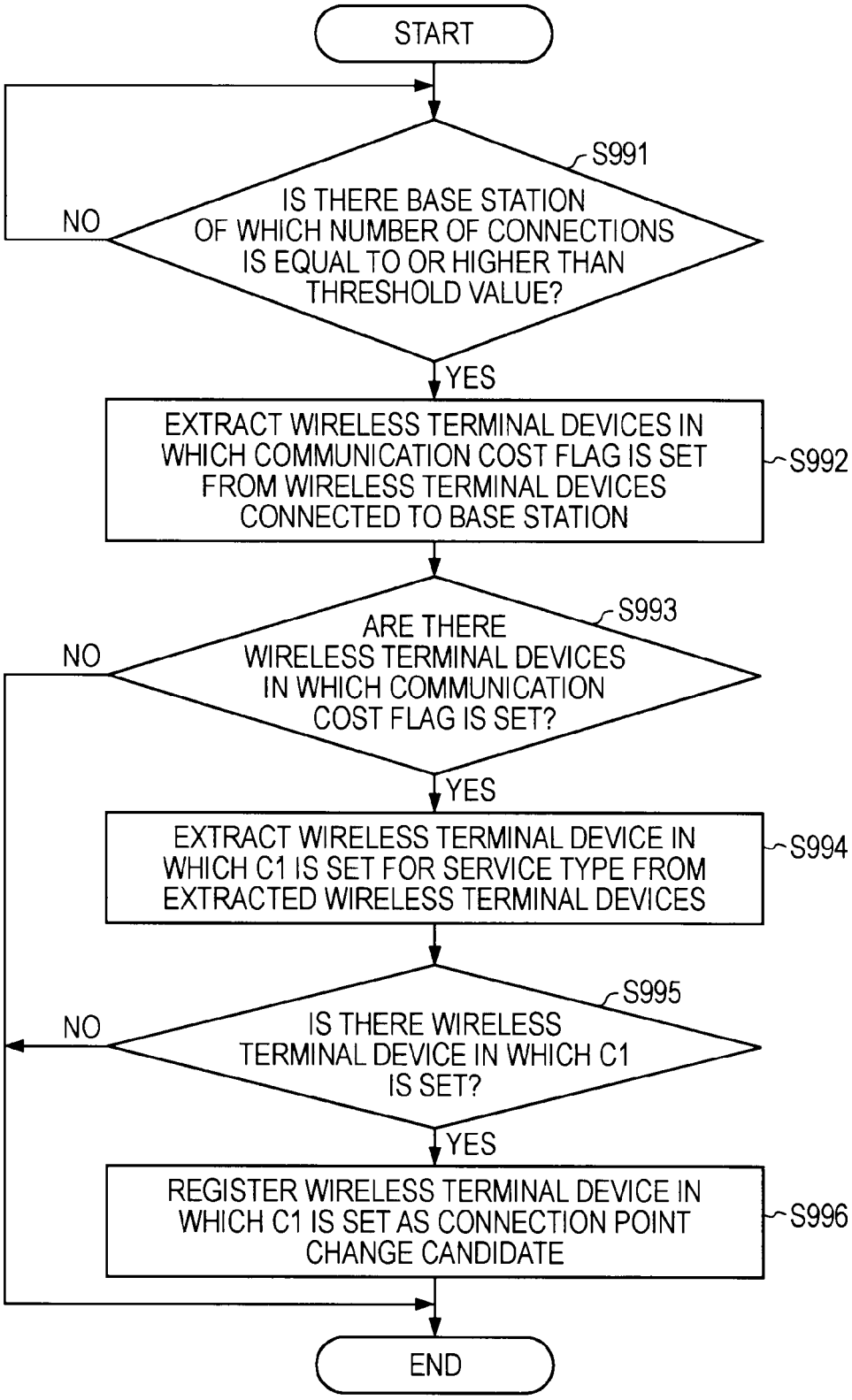

START
S991
IS THERE BASE STATION OF WHICH NUMBER OF CONNECTIONS IS EQUAL TO OR HIGHER THAN THRESHOLD VALUE?
NO
YES
EXTRACT WIRELESS TERMINAL DEVICES IN WHICH COMMUNICATION COST FLAG IS SET FROM WIRELESS TERMINAL DEVICES CONNECTED TO BASE STATION
S992
S993
ARE THERE WIRELESS TERMINAL DEVICES IN WHICH COMMUNICATION COST FLAG IS SET?
NO
YES
EXTRACT WIRELESS TERMINAL DEVICE IN WHICH C1 IS SET FOR SERVICE TYPE FROM EXTRACTED WIRELESS TERMINAL DEVICES
S994
S995
IS THERE WIRELESS TERMINAL DEVICE IN WHICH C1 IS SET?
NO
YES
REGISTER WIRELESS TERMINAL DEVICE IN WHICH C1 IS SET AS CONNECTION POINT CHANGE CANDIDATE
S996
END

FIG. 27

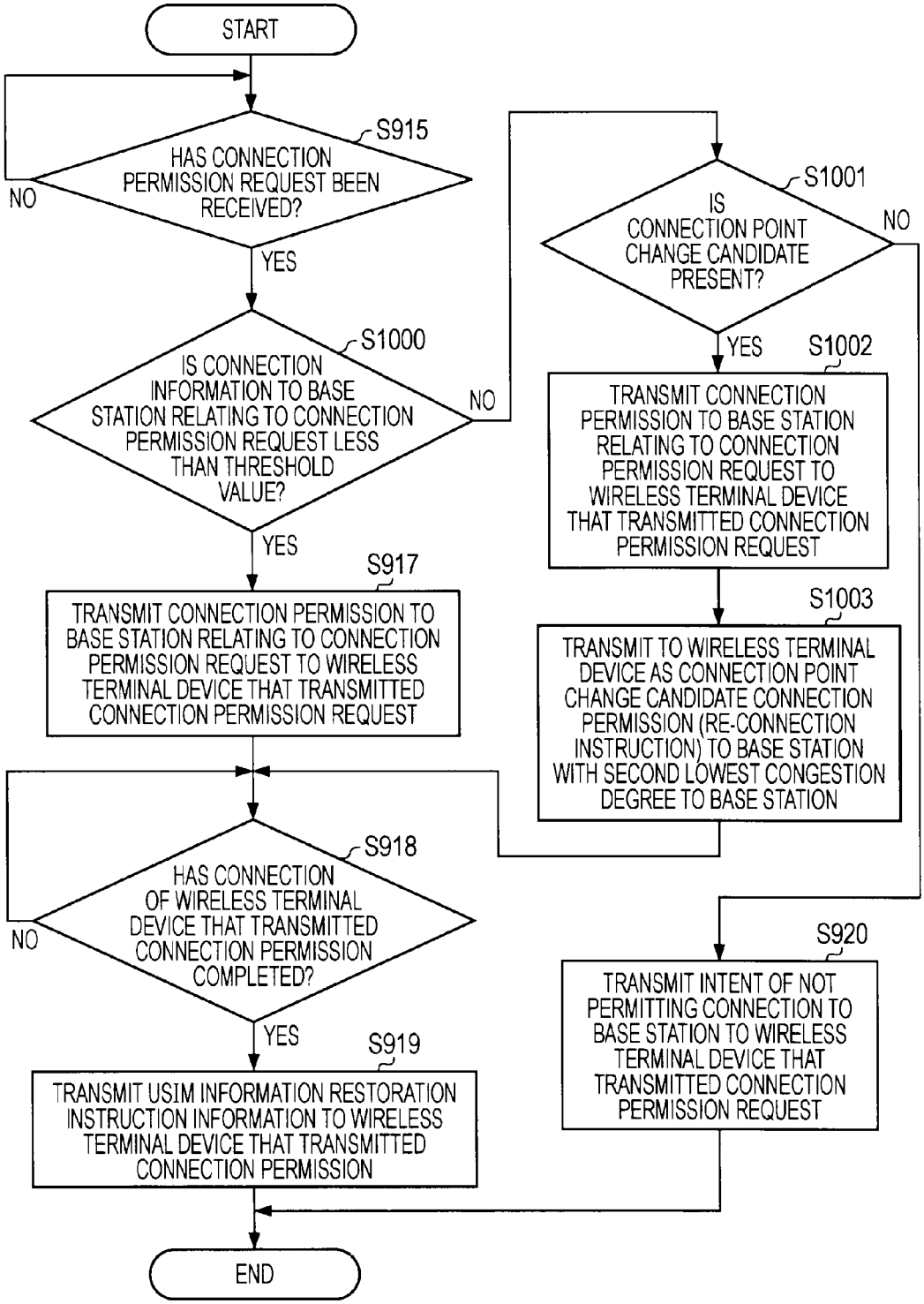

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S1000
IS CONNECTION INFORMATION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION
S1001
IS CONNECTION POINT CHANGE CANDIDATE PRESENT?
NO
YES
S1002
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S1003
TRANSMIT TO WIRELESS TERMINAL DEVICE AS CONNECTION POINT CHANGE CANDIDATE CONNECTION PERMISSION (RE-CONNECTION INSTRUCTION) TO BASE STATION WITH SECOND LOWEST CONGESTION DEGREE TO BASE STATION
S920
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
END

FIG. 28

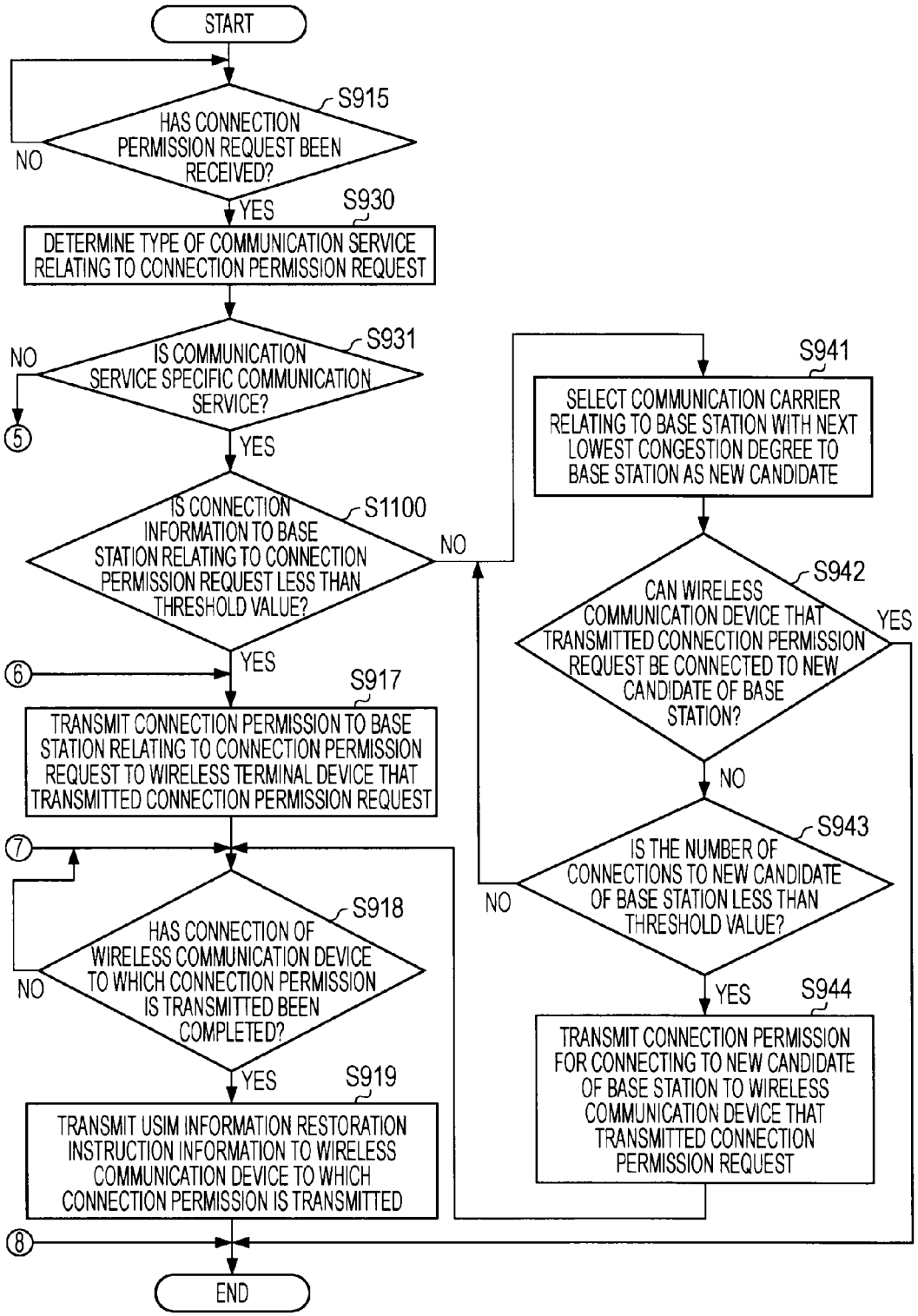

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S930
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S931
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
NO
5
YES
S1100
IS CONNECTION INFORMATION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
6
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
7
S918
HAS CONNECTION OF WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED BEEN COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
8
END
S941
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION WITH NEXT LOWEST CONGESTION DEGREE TO BASE STATION AS NEW CANDIDATE
S942
CAN WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST BE CONNECTED TO NEW CANDIDATE OF BASE STATION?
YES
NO
S943
IS THE NUMBER OF CONNECTIONS TO NEW CANDIDATE OF BASE STATION LESS THAN THRESHOLD VALUE?
NO
YES
S944
TRANSMIT CONNECTION PERMISSION FOR CONNECTING TO NEW CANDIDATE OF BASE STATION TO WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST

FIG. 29

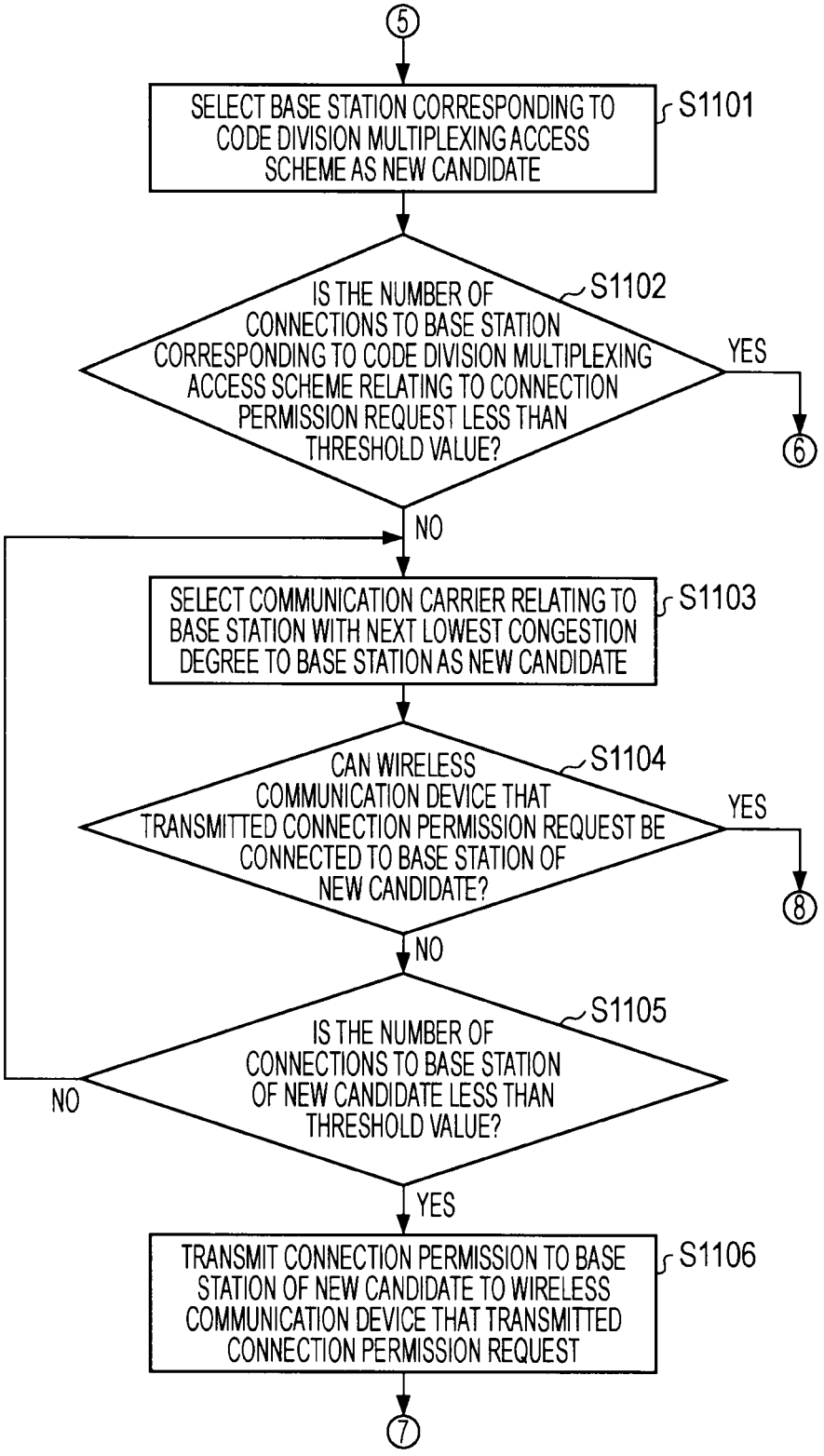

⑤
SELECT BASE STATION CORRESPONDING TO CODE DIVISION MULTIPLEXING ACCESS SCHEME AS NEW CANDIDATE
S1101
IS THE NUMBER OF CONNECTIONS TO BASE STATION CORRESPONDING TO CODE DIVISION MULTIPLEXING ACCESS SCHEME RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
S1102
YES
⑥
NO
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION WITH NEXT LOWEST CONGESTION DEGREE TO BASE STATION AS NEW CANDIDATE
S1103
CAN WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST BE CONNECTED TO BASE STATION OF NEW CANDIDATE?
S1104
YES
⑧
NO
IS THE NUMBER OF CONNECTIONS TO BASE STATION OF NEW CANDIDATE LESS THAN THRESHOLD VALUE?
S1105
NO
YES
TRANSMIT CONNECTION PERMISSION TO BASE STATION OF NEW CANDIDATE TO WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S1106
⑦

FIG. 30

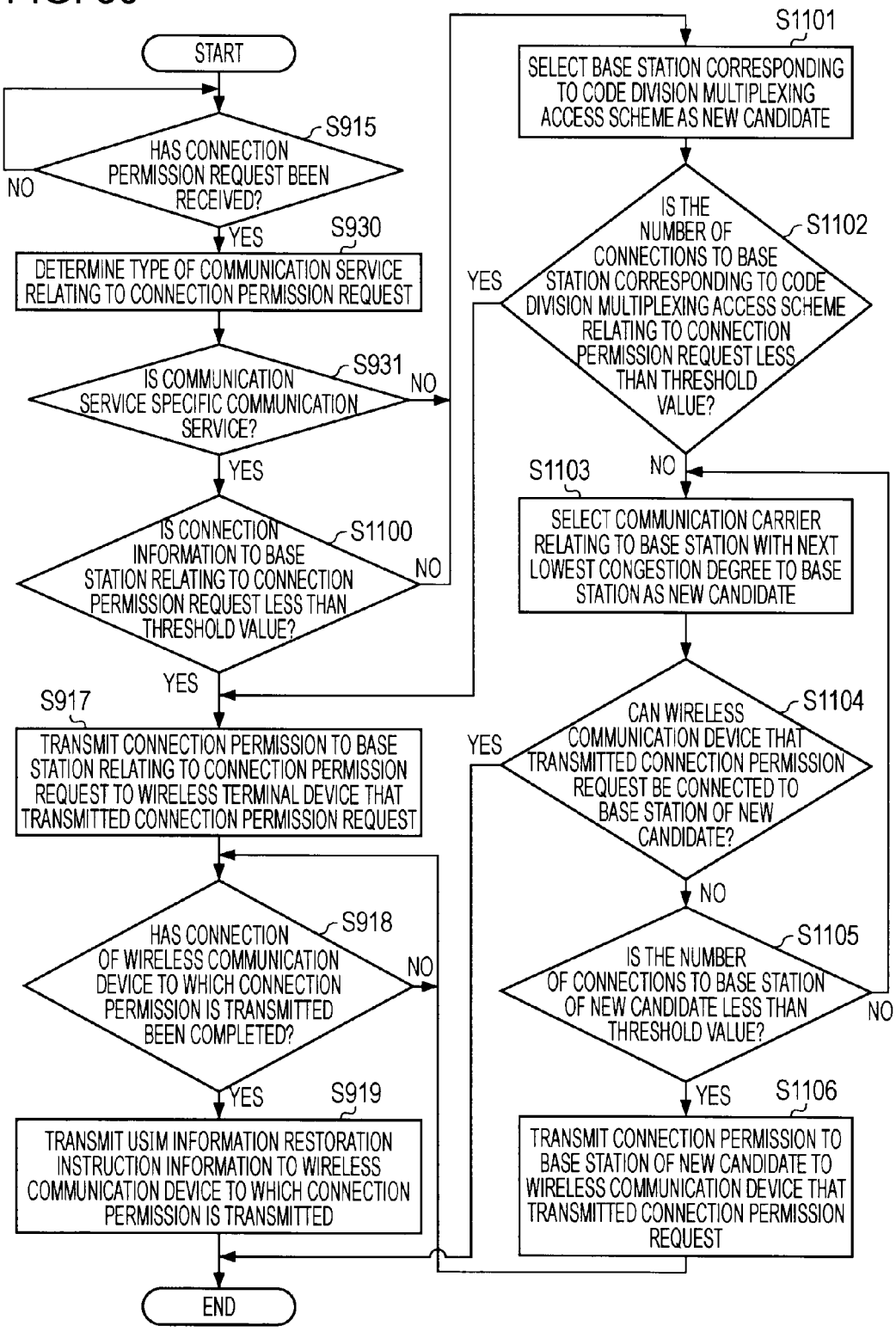

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S930
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S931
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
NO
YES
S1100
IS CONNECTION INFORMATION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S918
HAS CONNECTION OF WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED BEEN COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
END
S1101
SELECT BASE STATION CORRESPONDING TO CODE DIVISION MULTIPLEXING ACCESS SCHEME AS NEW CANDIDATE
S1102
IS THE NUMBER OF CONNECTIONS TO BASE STATION CORRESPONDING TO CODE DIVISION MULTIPLEXING ACCESS SCHEME RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
YES
NO
S1103
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION WITH NEXT LOWEST CONGESTION DEGREE TO BASE STATION AS NEW CANDIDATE
S1104
CAN WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST BE CONNECTED TO BASE STATION OF NEW CANDIDATE?
YES
NO
S1105
IS THE NUMBER OF CONNECTIONS TO BASE STATION OF NEW CANDIDATE LESS THAN THRESHOLD VALUE?
NO
YES
S1106
TRANSMIT CONNECTION PERMISSION TO BASE STATION OF NEW CANDIDATE TO WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST

FIG. 31

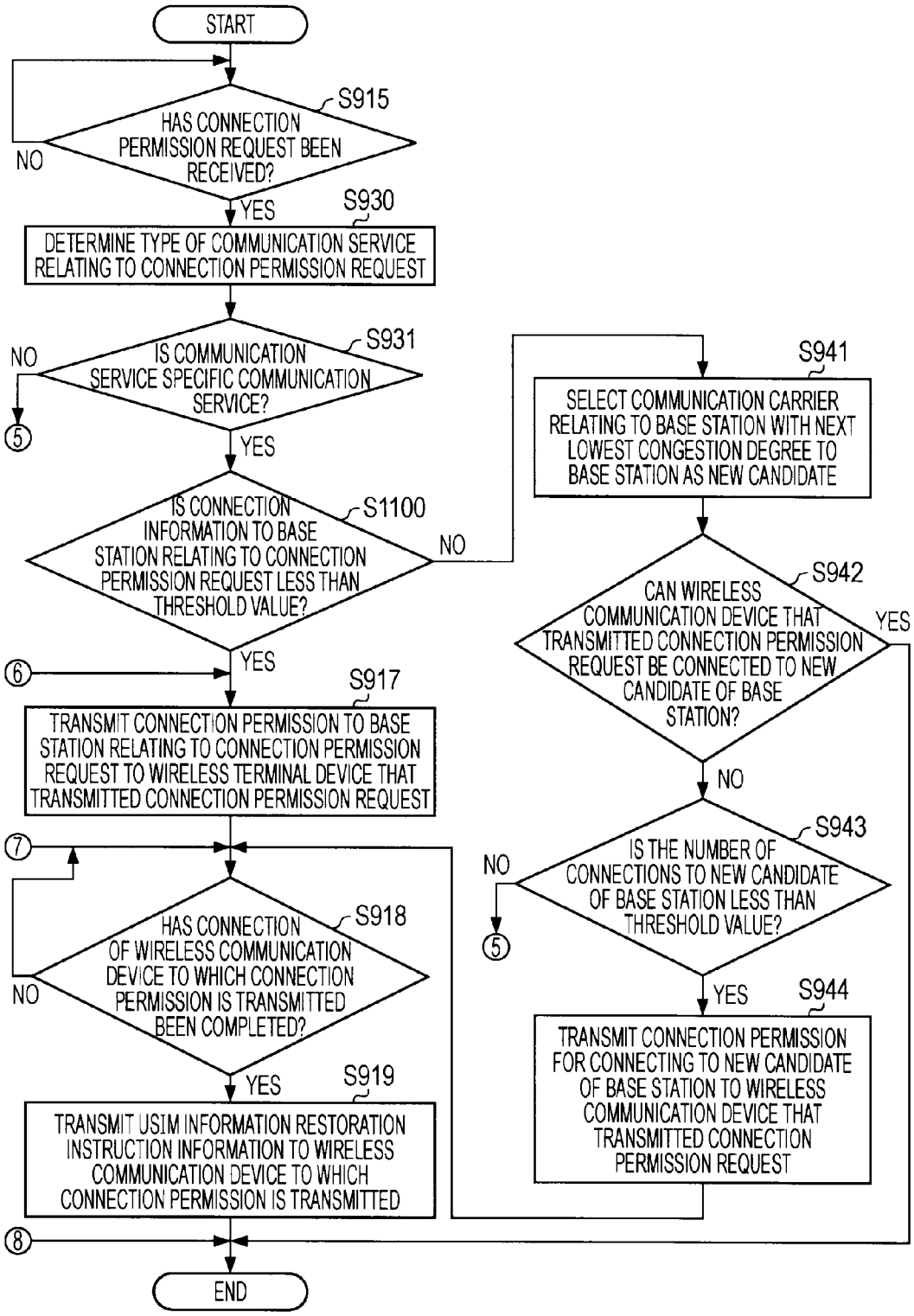
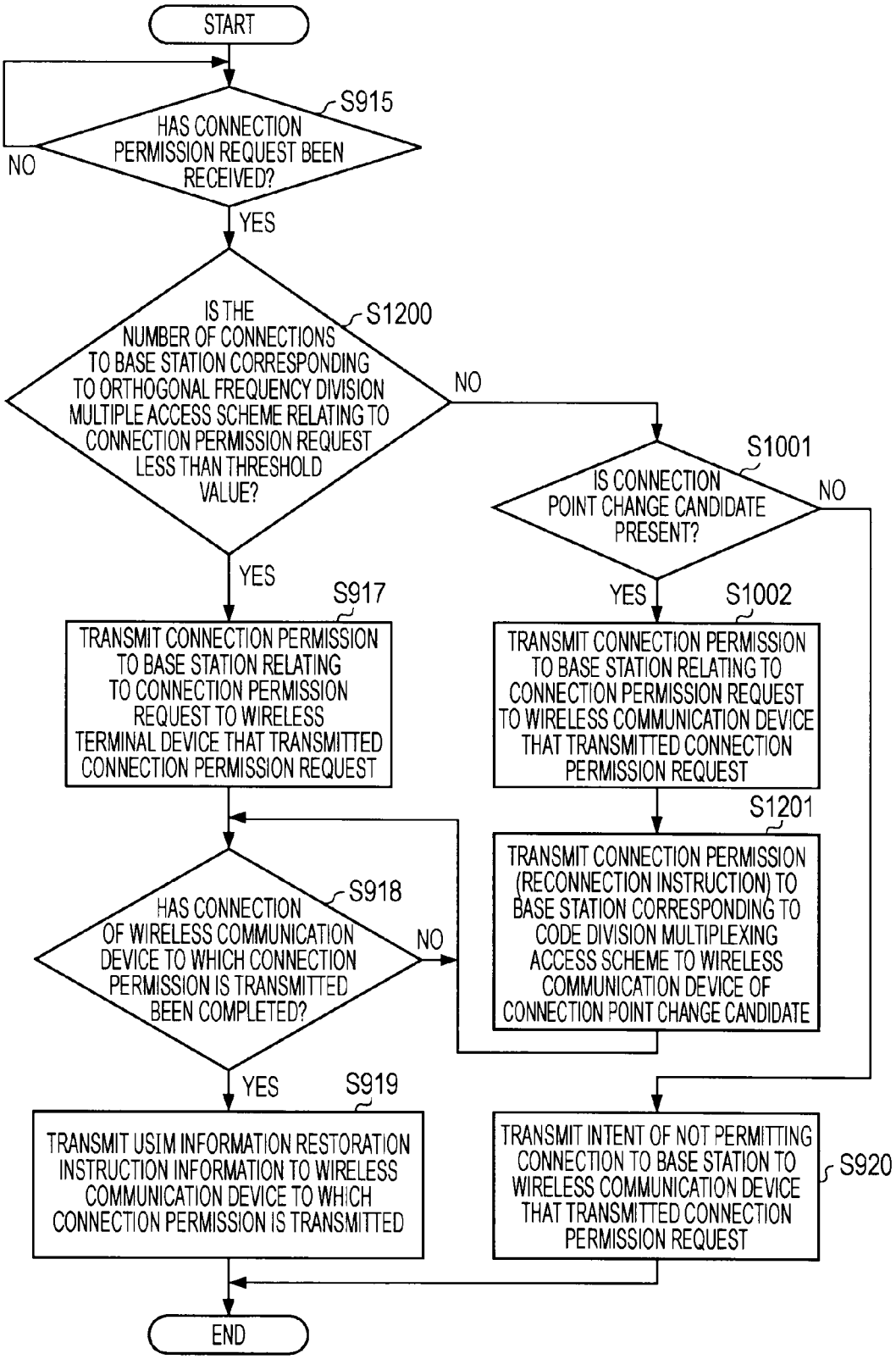

START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S930
DETERMINE TYPE OF COMMUNICATION SERVICE RELATING TO CONNECTION PERMISSION REQUEST
S931
IS COMMUNICATION SERVICE SPECIFIC COMMUNICATION SERVICE?
NO
⑤
YES
S1100
IS CONNECTION INFORMATION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
⑥
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
⑦
S918
HAS CONNECTION OF WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED BEEN COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
⑧
END
S941
SELECT COMMUNICATION CARRIER RELATING TO BASE STATION WITH NEXT LOWEST CONGESTION DEGREE TO BASE STATION AS NEW CANDIDATE
S942
CAN WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST BE CONNECTED TO NEW CANDIDATE OF BASE STATION?
YES
NO
S943
IS THE NUMBER OF CONNECTIONS TO NEW CANDIDATE OF BASE STATION LESS THAN THRESHOLD VALUE?
NO
⑤
YES
S944
TRANSMIT CONNECTION PERMISSION FOR CONNECTING TO NEW CANDIDATE OF BASE STATION TO WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST

FIG. 32


START
S915
HAS CONNECTION PERMISSION REQUEST BEEN RECEIVED?
NO
YES
S1200
IS THE NUMBER OF CONNECTIONS TO BASE STATION CORRESPONDING TO ORTHOGONAL FREQUENCY DIVISION MULTIPLE ACCESS SCHEME RELATING TO CONNECTION PERMISSION REQUEST LESS THAN THRESHOLD VALUE?
NO
YES
S1001
IS CONNECTION POINT CHANGE CANDIDATE PRESENT?
NO
YES
S917
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS TERMINAL DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S1002
TRANSMIT CONNECTION PERMISSION TO BASE STATION RELATING TO CONNECTION PERMISSION REQUEST TO WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S1201
TRANSMIT CONNECTION PERMISSION (RECONNECTION INSTRUCTION) TO BASE STATION CORRESPONDING TO CODE DIVISION MULTIPLEXING ACCESS SCHEME TO WIRELESS COMMUNICATION DEVICE OF CONNECTION POINT CHANGE CANDIDATE
S918
HAS CONNECTION OF WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED BEEN COMPLETED?
NO
YES
S919
TRANSMIT USIM INFORMATION RESTORATION INSTRUCTION INFORMATION TO WIRELESS COMMUNICATION DEVICE TO WHICH CONNECTION PERMISSION IS TRANSMITTED
TRANSMIT INTENT OF NOT PERMITTING CONNECTION TO BASE STATION TO WIRELESS COMMUNICATION DEVICE THAT TRANSMITTED CONNECTION PERMISSION REQUEST
S920
END

INFORMATION PROCESSING METHOD, INFORMATION PROCESSING DEVICE COMMUNICATION SYSTEM

BACKGROUND

The present disclosure relates to an information processing method, and particularly to an information processing method, an information processing device, and a communication system pertaining to wireless communication.

In the related art, wireless communication devices have been widely distributed which connect to a network including a public wireless network, or the like. In addition, the 3G type mobile telephone service (which is called the third generation in Japan) was started in 2002. In the mobile telephone service, services including voice, email, and the like having a less number of packets were the main applications. With the adoption of HSDPA (High Speed Downlink Packet Access), or the like, however, the user's utilization behavior has been changing to downloading packets of a relatively large size such as downloading music files, viewing videos, and the like.

In addition, it is assumed that users are concentrated on a specific area (base station), and accordingly, traffic is concentrated regionally due to downloading large capacity packets. In this case, a problem occurs in that a sufficient communication rate is not obtained, or the like.

Thus, when a request for distributing content is made from a wireless communication device, for example, a distribution system has been proposed in which the possibility of the distribution is determined according to the reception environment in a wireless communication device (for example, refer to Japanese Unexamined Patent Application Publication No. 2002-78020).

SUMMARY

In the related art described above, when the reception environment is not favorable for a wireless communication device, distribution of content is not performed in the wireless communication device. In this case, for example, the distribution itself is stopped, or the reception environment is judged after a predetermined time passes and then the possibility of the distribution is determined again according to the reception environment.

However, when the reception environment is not favorable for the wireless communication device, there is a possibility of getting a proper wireless connection service in a way that the wireless communication device uses another wireless communication network.

It is desirable for the present disclosure to provide a proper wireless connection service.

The present disclosure is implemented in order to solve the above problem, and according to an embodiment of the present disclosure, there are provided an information processing method and a program that causes a computer to execute the method, which includes determining, when a connection request for connecting, via a base station relating to a first communication carrier, a first wireless communication device to a base station relating to a second communication carrier is received from the first wireless communication device, permission or non-permission for the connection request based on connection information on the number of wireless communication devices connected to the base station relating to the connection request, and setting a connection right to be connected to the base station relating to the connection request to the first wireless communication device when permission is determined in the determining. Accordingly, when the connection request is received from the first wireless communication device, permission or non-permission for the connection request is determined based on the connection information on the number of wireless communication devices connected to the base station relating to the connection request, and when permission is determined, an effect is exhibited such that the connection right to be connected to the base station relating to the connection request is set to the first wireless communication device is brought.

In the determining, the connection information may be compared to a threshold value, and permission or non-permission for the connection request may be determined based on the comparison result. Accordingly, an effect is exhibited such that the connection information and the threshold value are compared and permission or non-permission for the connection request is determined based on the comparison result is brought.

In addition, according to the embodiment, the connection request may be a connection request for being connected to the base station with the lowest congestion degree among a plurality of base stations to which the first wireless communication device can be connected, in the determining, when the number of wireless communication devices connected to the base station relating to the connection request is great based on the threshold value as a standard, a base station with the next lowest congestion degree to the base station relating to the connection request among the plurality of base stations to which the first wireless communication device can be connected may be set to a target base station, and when the number of wireless communication devices connected to the target base station is less based on the threshold value as a standard, permission for connection to the target base station may be determined, and when the number is great based on the threshold value as a standard, such determination may be performed for the target base station by setting a base station with the further next lowest congestion degree to the target base station among the plurality of base stations to which the first wireless communication device can be connected as a new target base station, and, in the setting, a connection right to be connected to the target base station for which permission is determined in the determining may be set to the first wireless communication device. Furthermore, herein, the case where the number is great based on the threshold value as a standard includes both meanings of when the number is equal to or greater than the threshold value and when the number is greater than the threshold value. In addition, the case where the number is less based on the threshold value as a standard includes both meanings of when the number is equal to or less than the threshold value and when the number is less than the threshold value. However, when the case where the number is great based on the threshold value as a standard indicates being equal to or greater than the threshold, the case where the number is less based on the threshold value as a standard indicates being less than the threshold value. On the other hand, when the case where the number is great based on the threshold value as a standard indicates being greater than the threshold value, the case where the number is less based on the threshold value as a standard indicates being equal to or less than the threshold value. Accordingly, an effect is exhibited such that, when the number of wireless communication devices connected to the base station relating to the connection request is great based on the threshold value as a standard, a base station with the next lowest congestion degree to the base station relating to the connection request among the plurality of base stations to which the first wireless communication device can be connected is set to a target base station, and when the number of wireless communication devices

connected to the target base station is less based on the threshold value as a standard, permission for connection to the target base station is determined, and when the number is great based on the threshold value as a standard, such determination is performed for the target base station by setting a base station with the further next lowest congestion degree to the target base station among the plurality of base stations to which the first wireless communication device can be connected as a new target base station, and a connection right to be connected to the target base station for which permission is determined in the determining is set to the first wireless communication device.

In addition, according to the embodiment, in the determining, when the number of wireless communication devices connected to the base station relating to the connection request is less based on the threshold value as a standard, permission for the connection request may be determined, and when the number is great based on the threshold value as a standard, non-permission for the connection request may be determined. Accordingly, an effect is exhibited such that, when the number of wireless communication devices connected to the base station relating to the connection request is less based on the threshold value as a standard, permission for the connection request is determined, and when the number is great based on the threshold value as a standard, non-permission for the connection request is determined.

In addition, according to the embodiment, displaying, when non-permission for the connection request is determined in the determining, the intent of non-permission in the first wireless communication device may be further included. Accordingly, an effect is exhibited such that, when non-permission for the connection request is determined, the intent of non-permission is displayed in the first wireless communication device.

In addition, according to the embodiment, when a communication service relating to the connection request is not a specific communication service, the determination may be performed after a fixed time passes after the reception of the connection request in the determining, and, when permission for the connection request is determined after the fixed time passes, the connection right may be set to the first wireless communication device in the setting. Accordingly, an effect is exhibited such that, when a communication service relating to the connection request is not a specific communication service, the determination is performed after a fixed time passes after the reception of the connection request, and, when permission for the connection request is determined after the fixed time passes, the connection right is set to the first wireless communication device in the setting.

In addition, according to the embodiment, in the determining, when the communication service relating to the connection request is not a specific communication service, a base station with the next lowest congestion degree to the base station relating to the connection request among a plurality of base stations to which the first wireless communication device can be connected may be set as a target base station, when the number of wireless communication devices connected to the target base station is less based on the threshold value as a standard, permission for connection to the target base station may be determined, and when the number is great based on the threshold value as a standard, non-permission for connection to the target base station may be determined, and, in the setting, the connection right to be connected to the target base station for which permission is determined in the determining may be set for the first wireless communication device. Accordingly, an effect is exhibited that, when the communication service relating to the connection request is not a specific communication service, a base station with the next lowest congestion degree to the base station relating to the connection request among a plurality of base stations to which the first wireless communication device can be connected is set as a target base station, when the number of wireless communication devices connected to the target base station is less based on a threshold value as a standard, permission for connection to the target base station is determined, when the number is great based on the threshold value as a standard, non-permission for connection to the target base station is determined, and, the connection right to be connected to the target base station for which permission is determined is set for the first wireless communication device.

In addition, according to the embodiment, the connection request may be a first connection request for being connected to a base station that is selected based on the congestion degree relating to a plurality of base stations to which the first wireless communication device can be connected, or a second connection request for being connected to a base station that is selected based on a communication cost relating to the plurality of base stations to which the first wireless communication device can be connected, and in the determining, the determination may be performed using threshold values that are different depending on whether the connection request is the first connection request or the second connection request. Accordingly, an effect is exhibited such that determination is performed using threshold values that are different depending on whether the connection request is the first connection request or the second connection request.

In addition, according to the embodiment, in the determining, when the connection request is the first connection request, the determination may be performed using a first threshold value as the threshold value, and when the connection request is the second connection request, the determination may be performed using a second threshold value as the threshold value, in which conditions are further alleviated than in the first threshold value. Accordingly, an effect is exhibited such that, when the connection request is the first connection request, determination is performed using the first threshold value, and when the connection request is the second connection request, determination is performed using the second threshold value, in which conditions are further alleviated than in the first threshold value.

In addition, according to the embodiment, in the determining, when the type of the communication service relating to the connection request is a specific communication service regardless of whether the connection request is the first connection request or the second connection request, the determination may be performed using the first threshold value. Accordingly, an effect is exhibited such that, when the type of the communication service relating to the connection request is a specific communication service regardless of whether the connection request is the first connection request or the second connection request, the determination is performed using the first threshold value.

In addition, according to the embodiment, in the determining, a connection request to be permitted may be specified among the connection requests based on the congestion degree relating to a plurality of base stations to which the first wireless communication device can be connected and the type of a communication service relating to the connection request. Accordingly, an effect is exhibited such that a connection request to be permitted is specified among the connection requests based on the congestion degree relating to a plurality of base stations to which the first wireless communication device can be connected and the type of a communication service relating to the connection request.

In addition, according to the embodiment, the congestion degree of each base station may be transmitted to an information processing device that executes the determination after each wireless communication device detects the congestion degree, and frequency of transmitting congestion degrees detected by the wireless communication device to the information processing device may be increased as the distance between the wireless communication device and the base station is shortened, and frequency of transmitting congestion degrees detected by the wireless communication device to the information processing device may be reduced as the distance between the wireless communication device and the base station is lengthened. Accordingly, an effect is exhibited such that the frequency of transmitting congestion degrees detected by the wireless communication device to the information processing device is increased as the distance between the wireless communication device and the base station is shortened, and frequency of transmitting congestion degrees detected by the wireless communication device to the information processing device is reduced as the distance between the wireless communication device and the base station is lengthened.

In addition, according to the embodiment, extracting a wireless communication device is further included of which the type of a communication service relating to the connection request does not coincide with the type of a communication service communicated between the base station relating to the connection request after connection based on the set connection right, in the determining, when a wireless communication device, of which the types of the communication service do not coincide with each other, is extracted even if non-permission for the connection request is determined based on the comparison result, permission for the connection request may be determined, and in the setting, a connection right to be connected to a base station with the next lowest congestion degree to another base station relating to the connection right set in the extracted wireless communication device may be set in the wireless communication device. Accordingly, an effect is exhibited such that, when a wireless communication device, of which the type of the communication service relating to the connection request does not coincide with the type of a communication service performed between the base station relating to the connection request after connection based on the set connection right, is extracted even if non-permission for the connection request is determined based on the comparison result with the threshold value, permission for the connection request is determined, and a connection right to be connected to a base station with the next lowest congestion degree to another base station relating to the connection right set in the extracted wireless communication device is set in the extracted wireless communication device.

In addition, according to the embodiment, in the determining, the determination may be performed using a value, as the connection information, obtained by weighting the number of wireless communication devices connected to the base station relating to the connection request based on the distance between the base station and each of the wireless communication devices, or a value obtained by weighting the number of wireless communication devices based on a signal-power-to-interference-power ratio of a pilot signal received from the base station. Accordingly, an effect is exhibited such that determination is performed using a value obtained by weighting the number of wireless communication devices connected to the base station relating to the connection request based on the distance between the base station and each of the wireless communication devices, or a value obtained by weighting the number of wireless communication devices based on a signal-power-to-interference-power ratio of a pilot signal received from the base station.

In addition, according to the embodiment, the base station relating to the connection request may be selected based on the congestion degrees or a predicted communication rate of a plurality of base stations. Accordingly, an effect is exhibited such that the base station relating to the connection request is selected based on the congestion degrees or a predicted communication rate of a plurality of base stations.

In addition, according to the embodiment, determining a service type may be further included by determining whether a service is a continuously provided communication service or an intermittently provided communication service based on at least one of a connection point, a protocol, and a port number included in the connection request. Accordingly, an effect is exhibited of determining whether a service is a continuously provided communication service or an intermittently provided communication service.

In addition, according to the embodiment, in the determining, when the communication service relating to the connection request is a specific communication service, a base station corresponding to the orthogonal frequency division multiple access scheme among a plurality of base stations to which the first wireless communication device can be connected may be set as a target base station, when the communication service relating to the connection request is not a specific communication service, a base station corresponding to the code division multiplexing access scheme among the plurality of base stations to which the first wireless communication device can be connected may be set as a target base station, and when the number of wireless communication devices connected to the target base station is small based on a threshold value, permission for connection to the target base station may be determined, and when the number is great based on the threshold value, non-permission for connection to the target base station may be determined, and in the setting, the connection right to be connected to the target base station to which connection is determined to be permitted in the determining may be set in the first wireless communication device. Accordingly, an effect is exhibited such that, when the number of wireless communication devices connected to the target base station is small based on the threshold value, permission for connection to the target base station is determined, when the number is great based on the threshold value, non-permission for connection to the target base station is determined, and the connection right to be connected to the target base station to which connection is determined to be permitted in the determining may be set in the first wireless communication device.

In addition, according to the embodiment, in the determining, when the communication service relating to the connection request is a specific communication service, a base station corresponding to the orthogonal frequency division multiple access scheme among the plurality of base stations to which the first wireless communication device can be connected may be set as a target base station, when the number of wireless communication devices connected to the target base station is small based on a threshold value, permission for connection to the target base station may be determined, and when the number is great based on the threshold value, a base station corresponding to the code division multiplexing access scheme among the plurality of base stations to which the first wireless communication device can be connected may be set as a new target base station, when the number of wireless communication devices connected to the target base station is small based on a thresh-

old value, permission for connection to the base station may be determined, and when the number is great based on the threshold value, non-permission for connection to the target base station may be determined, and in the setting, the connection right to be connected to the target base station to which connection is determined to be permitted in the determining may be set in the first wireless communication device. Accordingly, an effect is exhibited such that, when the number of wireless communication devices connected to the target base station is small based on the threshold value, permission for connection to the target base station is determined, when the number is great based on the threshold value, non-permission for connection to the target base station is determined, and the connection right to be connected to the target base station to which connection is determined to be permitted in the determining may be set in the first wireless communication device.

In addition, according to the embodiment, extracting a wireless communication device of which the type of a communication service relating to the connection request does not coincide with the type of a communication service communicated between the base station relating to the connection request after connection based on the set connection right is further included, in the determining, when a wireless communication device, of which the types of the communication services do not coincide with each other, is extracted even if non-permission is determined for the connection request based on the comparison result, permission for the connection request may be determined, and in the setting, the extracted wireless communication device may be set with the connection right to be connected to a base station corresponding to the code division multiplexing access scheme from a base station corresponding to the orthogonal frequency division multiple access scheme relating to a connection right set in the wireless communication device. Accordingly, an effect is exhibited such that, when a wireless communication device, of which the types of the communication services do not coincide with each other, is extracted even if non-permission for the connection request is determined based on the comparison result, permission for the connection request is determined, and the extracted wireless communication device is set with the connection right to be connected to the base station corresponding to the code division multiplexing access scheme from the base station corresponding to the orthogonal frequency division multiple access scheme relating to the connection right set in the wireless communication device.

In addition, according to another embodiment of the present disclosure, there are provided an information processing device, an information processing method thereof, and a program that causes a computer to execute the method, the device including a determination unit that determines, when a connection request for connecting, via a base station relating to a first communication carrier, a first wireless communication device to a base station relating to a second communication carrier is received from the first wireless communication device, permission or non-permission for the connection request based on connection information on the number of wireless communication devices connected to a base station relating to the connection request, and a control unit that controls to set a connection right to be connected to the base station relating to the connection request to the first wireless communication device when permission is determined by the determination unit. Accordingly, an effect is exhibited such that, when the connection request is received from the first wireless communication device, permission or non-permission for the connection request is determined based on connection information on the number of wireless communication devices connected to the base station relating to the connection request, and when permission is determined, the connection right to be connected to the base station relating to the connection request is set to the first wireless communication device.

In addition, according to still another embodiment of the present disclosure, there are provided a communication system including a first wireless communication device that can be connected to a base station relating to a first communication carrier, and an information processing device that includes a determination unit that determines, when a connection request for being connected to a base station relating to a second communication carrier is received from the first wireless communication device via the base station relating to the first communication carrier, permission or non-permission for the connection request is determined based on connection information on the number of wireless communication devices connected to a base station relating to the connection request, and a control unit that controls to set a connection right to be connected to the base station relating to the connection request to the first wireless communication device when permission is determined by the determination unit, an information processing method, and a program that causes a computer to execute the method. Accordingly, an effect is exhibited such that, when the connection request is received from the first wireless communication device, permission or non-permission for the connection request based on the connection information on the number of wireless communication devices connected to the base station relating to the connection request, and when permission is determined, the connection right to be connected to the base station relating to the connection request is set to the first wireless communication device.

According to the present disclosure, an excellent effect in that a proper wireless connection service can be provided is exhibited.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing a system configuration example of a communication system according to a first embodiment of the present disclosure;

FIG. **2** is a block diagram showing a functional configuration example of a wireless communication device according to the first embodiment of the present disclosure;

FIG. **3** is a block diagram showing a functional configuration example of an information processing device according to the first embodiment of the present disclosure;

FIG. **4** is a diagram schematically showing an example of stored content of a congestion degree information retaining unit according to the first embodiment of the present disclosure;

FIG. **5** is a diagram schematically showing an example of retained content of a communication cost information retaining unit according to the first embodiment of the present disclosure;

FIGS. **6**A and **6**B are diagrams schematically showing an example of retained content of wireless communication device information retaining units according to the first embodiment of the present disclosure;

FIGS. **7**A and **7**B are diagrams schematically showing a determination example when a communication service type determination unit determines the type of a communication service according to the first embodiment of the present disclosure;

FIG. **8** is a sequence chart showing a communication processing example between each device constituting the communication system according to the first embodiment of the present disclosure;

FIG. **9** is the sequence chart showing the communication processing example between each device constituting the communication system according to the first embodiment of the present disclosure;

FIGS. **10**A and **10**B are diagrams showing a display screen example displayed in the wireless communication device according to the first embodiment of the present disclosure;

FIG. **11** is a flowchart showing an example of a processing procedure of a communication service control process by the wireless communication device according to the first embodiment of the present disclosure;

FIG. **12** is a flowchart showing an example of a processing procedure of a USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **13** is a flowchart showing an example of the processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **14** is a flowchart showing an example of the processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **15** is a flowchart showing an example of a processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIGS. **16**A and **16**B are diagrams showing display screen examples displayed in the wireless communication device according to the first embodiment of the present disclosure;

FIG. **17** is a flowchart showing an example of a processing procedure of a communication service control process by the wireless communication device according to the first embodiment of the present disclosure;

FIG. **18** is a flowchart showing an example of a processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **19** is a flowchart showing an example of a processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **20** is a flowchart showing an example of the processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIGS. **21**A and **21**B are diagrams showing an example of criteria of determination used in a connection determination process by a connection permission determination unit according to the first embodiment of the present disclosure;

FIG. **22** is a block diagram showing a functional configuration example of an information processing device according to a second embodiment of the present disclosure;

FIG. **23** is a diagram schematically showing an example of retained content of a wireless communication device information retaining unit according to the second embodiment of the present disclosure;

FIG. **24** is a flowchart showing an example of a processing procedure of a wireless communication device information updating control process by the information processing device according to the second embodiment of the present disclosure;

FIG. **25** is a flowchart showing an example of a processing procedure of a connection point change candidate registration control process by the information processing device according to the second embodiment of the present disclosure;

FIG. **26** is a flowchart showing an example of a processing procedure of a connection point change candidate registration control process by the information processing device according to the second embodiment of the present disclosure;

FIG. **27** is a flowchart showing an example of a processing procedure of a USIM information rewriting control process by the information processing device according to the second embodiment of the present disclosure.

FIG. **28** is a flowchart showing another example of a processing procedure of a USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **29** is a flowchart showing the example of the processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **30** is a flowchart showing another example of the processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure;

FIG. **31** is a flowchart showing still another example of the processing procedure of the USIM information rewriting control process by the information processing device according to the first embodiment of the present disclosure; and

FIG. **32** is a flowchart showing another example of the processing procedure of the USIM information rewriting control process by the information processing device according to the second embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

Hereinafter, embodiments for implementing the present disclosure (hereinafter, referred to as embodiments) will be described. Description thereof will be provided in the following order.

1. First Embodiment (USIM (Universal Subscriber Identity Module) information rewriting control: An example in which a connection permission determination process is performed according to a request of connection permission from a wireless communication device and USIM information is rewritten based on the determination result)

2. Second Embodiment (USIM information rewriting control: An example in which a connection permission determination process is performed according to a request of connection permission from a wireless communication device and, when a predetermined condition is satisfied, USIM information of the wireless communication device and a connection point change candidate is rewritten)

1. First Embodiment

Configuration Example of Communication System

FIG. **1** is a block diagram showing a system configuration example of a communication system **100** according to a first embodiment of the present disclosure.

The communication system **100** includes a public network **101**, a first network control device **120**, a second network control device **140**, base stations **121** and **141**, an information processing device **200**, and a plurality of wireless communication devices (**11** to **14**, **300**, and the like). Furthermore, the wireless communication device **300** is, for example, a mobile telephone device (for example, a mobile telephone device or

a smartphone having a call function and a data communication function), a data communication device (for example, a personal computer) having a wireless communication function, or the like. In addition, each wireless communication device has an initial setting of the parameters necessary for being connected to wireless communication networks that are managed and operated by at least one communication carrier based on a contract with each communication carrier (or a contract with a carrier equivalent to the form of a virtual communication enterprise). The setting of the parameters is performed by, for example, rewriting USIM information necessary for connecting to a wireless communication network managed by a communication carrier.

The public network **101** is a public network such as a telephone network, the Internet, or the like. In addition, the public network **101** is connected to the first network control device **120** and the second network control device **140** through a gateway (not shown in the drawing).

The base station **121** is a base station managed by a first communication carrier, and is a mobile communication base station (NodeB) that connects a wireless communication device retaining USIM information of the first communication carrier and the first network control device **120** through a radio channel. Herein, the USIM information is an example of contract authentication information, and the contract authentication information is information including telephone subscriber information and authentication key information. In other words, a user who owns the wireless communication device **300** makes a contract with the first communication carrier in regard to a wireless connection service. In addition, the contract is also a contract that enables the user who owns the wireless communication device **300** to use the base station **121** that is operated by the first communication carrier.

The base station **141** is a base station that is operated by a second communication carrier, and is a mobile communication base station (NodeB) that connects a wireless communication device retaining USIM information of the second communication carrier and the second network control device **140** through a radio channel. Furthermore, the first communication carrier and the second communication carrier are mobile communication carriers that provide a wireless connection service.

In addition, FIG. **1** shows a range where radio waves of the base station **121** reach (wireless communication range) as a cell **122** and a range where radio waves of the base station **141** reach (wireless communication range) as a cell **142**.

Furthermore, in the embodiments of the present disclosure, a base station is set to have both meanings of a base station itself and a cell specified by the base station. For example, in the embodiments of the present disclosure, a contract for using a base station also means a contract for using a cell specified by the base station.

In addition, FIG. **1** shows only the first and the second communication carriers as communication carriers, but a case where there are three or more communication carriers can be applied in the same manner. For the sake of description simplicity, FIG. **1** shows only the base stations **121** and **141** as base stations operated by each communication carriers, but a case where there are three or more base stations operated by each communication carriers can be applied in the same manner.

The first network control device **120** is a communication control device managed by the first communication carrier that provides a wireless connection service, and performs authentication control of a wireless communication device connected through the base station **121**. In addition, the first network control device **120** connects the authenticated wireless communication device to the public network **101** via a gateway (not shown in the drawing).

The second network control device **140** is a communication control device managed by the second communication carrier that provides a wireless connection service, and performs authentication control of a wireless communication device connected through the base station **141**. In addition, the second network control device **140** connects the authenticated wireless communication device to the public network **101** via a gateway (not shown in the drawing).

Herein, the first network control device **120** authenticates only a wireless communication device retaining USIM information (contract authentication information) pertaining to the first communication carrier among wireless communication devices connected through the base station **121** except for a specific case. In addition, in the same manner, the second network control device **140** authenticates only a wireless communication device retaining USIM information (contract authentication information) pertaining to the second communication carrier among wireless communication devices connected through the base station **141** except for a specific case. Furthermore, such a specific case is, for example, a case of calling out in an emergency (for example, a case of calling out police officers or firefighters).

The first and the second network control devices **120** and **140** output various items of information transmitted from respective wireless communication devices through respective base stations to the information processing device **200**, and transmits various items of information output from the information processing device **200** to respective wireless communication device through respective base stations.

The information processing device **200** is an information processing device operated by a carrier providing various communication services. In addition, the information processing device **200** performs a rewriting process and a restoration process of USIM information of a wireless communication device based on information from the first and the second network control devices **120** and **140**. Herein, a carrier providing various communication services includes a communication carrier providing a wireless connection service, an MVNO (Mobile Virtual Network Operator) (a carrier of business in the form of so-called virtual communication), or the like. Furthermore, the information processing device **200** will be described in detail with reference to FIG. **3**.

Herein, when there are a number of other wireless communication devices that are connected to the base station **121** that the wireless communication device **300** can be connected, a case is assumed in which a user of the wireless communication device **300** uses a high-speed communication service with the wireless communication device **300**. For example, when there are a small number of other wireless communication devices that are connected to the base station **141** that the wireless communication device **300** can be connected to, it is assumed that it is possible to use a high-speed communication service by connecting the wireless communication device **300** to the base station **141**. However, for example, when there is a large number of other wireless communication device connected to the base station **141** that the wireless communication device **300** is connected, it is also considered that it is difficult to use a high-speed communication service even when the wireless communication device **300** is connected to the base station **141**. Thus, the first embodiment of the present disclosure shows that an example in which a proper base station (communication carrier) for the wireless communication device **300** is selected so as to make use of a desired communication service through the base station (communication carrier). In this case, for example, a connec-

tion permission determination process is performed in regard to the number of wireless communication devices connected to the selected base station, and USIM information is rewritten based on the determination result.

[Configuration Example of Wireless Communication Device]

FIG. **2** is a block diagram showing a functional configuration example of the wireless communication device **300** according to the first embodiment of the present disclosure.

The wireless communication device **300** includes a communication unit **310**, a positional information acquisition unit **320**, a control unit **330**, an operation reception unit **340**, a display unit **350**, a USIM information rewriting unit **360**, a USIM information storage unit **370**, a congestion degree information storage unit **380**, and a communication cost information storage unit **390**. The wireless communication device **300** is realized by a mobile telephone device that can carry out, for example, phone calls and data communication. Furthermore, a microphone, a speaker, and the like are omitted from the drawing and description.

The communication unit **310** is a communication unit for a plurality of wireless communication services including a reception unit that receives radio signals transmitted from each base station and a transmission unit that transmits wireless signals to each base station. For example, the communication unit **310** can communicate according to CDMA (Code Division Multiple Access), or OFDMA (Orthogonal Frequency Division Multiple Access).

The positional information acquisition unit **320** acquires positional information indicating a position where the wireless communication device **300** is present, and outputs the acquired positional information to the control unit **330**. The positional information acquisition unit **320** can be realized by a GPS unit that computes positional information based on GPS signals received by, for example, a GPS (Global Positioning System) signal reception antenna. The computed positional information includes various data pertaining to the position such as the latitude, the longitude, and the altitude at the time of receiving GPS signals. In addition, a positional information acquisition device may be used which acquires positional information by other positional information acquisition methods. A positional information acquisition device may be used, which acquires positional information by, for example, deriving the positional information using access point information that is linked to a wireless LAN (Local Area Network) present in the periphery thereof.

The control unit **330** is a unit that performs various control based on a control program saved in a memory (not shown in the drawing). The control unit **330** is constituted by, for example, a microprocessor. The control unit **330** is connected to, for example, the communication unit **310**, and transmits and receives various data between the first and the second network control devices **120** and **140** connected through the base stations **121** and **141**.

The operation reception unit **340** is an operation reception unit that receives an operation input operated by a user, and outputs signals according to the received operation input to the control unit **330**. The operation reception unit **340** includes, for example, various keys including numeric keys, alphabet keys, and the like.

The display unit **350** is a display unit that displays various items of information (character information, time information, and the like) based on the control of the control unit **330**. The display unit **350** displays, for example, information pertaining to before and after rewriting of USIM information (for example, a display screen shown in FIG. **10**). Furthermore, as the display unit **350**, it is possible to use a display panel, for example, an organic EL (Electro Luminescence) panel, an LCD (Liquid Crystal Display) panel, or the like. Furthermore, the operation reception unit **340** and the display unit **350** can be configured in an integrated manner using a touch panel that enables a user to perform an operation input by bringing a finger of the user into contact with or close to the display face thereof.

The USIM information rewriting unit **360** is to perform a rewriting process of USIM information (contract authentication information) retained in the USIM information storage unit **370** based on the control of the control unit **330**. Herein, a state of retaining the USIM information pertaining to the first communication carrier can be understood as a state of having a connection right to connecting to the base station **121** pertaining to the first communication carrier. For example, it is possible to transfer the connection right through a validation process and invalidation process of the USIM information. In addition, it is possible to transfer the connection right through a forwarding process of the USIM information itself. In addition, the state of retaining the USIM information pertaining to the first communication carrier can be understood as a state in which parameters necessary for connecting to the base station **121** pertaining to the first communication carrier are set.

The USIM information storage unit **370** is a memory retaining the USIM information (contract authentication information). As the USIM information storage unit **370**, for example, a UICC (Universal Integrated Circuit) card may be used, or a dedicated memory for securely keeping the USIM information may be used. Furthermore, when a UICC card is used as the USIM information storage unit **370**, a card that enables a validation process and an invalidation process of the USIM information is used, not a card in which the USIM information is written in a fixed manner. In other words, an item that enables the USIM information rewriting unit **360** to perform a validation process and an invalidation process for the USIM information is used. Furthermore, the validation process and the invalidation process for the USIM information can be performed by a validation process and an invalidation process stipulated in 3GPP (Third Generation Partnership Project). These processes are performed in, for example, a shop for mobile telephone devices.

The congestion degree information storage unit **380** is a storage unit storing congestion degree information acquired from the information processing device **200**. For example, congestion degree information pertaining to a plurality of base station that can be received at the position where the wireless communication device **300** is present is received through the communication unit **310** and recorded.

The communication cost information storage unit **390** is a storage unit storing communication cost information acquired from the information processing device **200**. For example, communication cost information pertaining to a plurality of base station that can be received at the position where the wireless communication device **300** is present is received through the communication unit **310** and recorded. Furthermore, the congestion degree information and the communication cost information are periodically or non-periodically received by the communication unit **310** in a sequential manner, and the content of the congestion degree information storage unit **380** and the communication cost information storage unit **390** is sequentially updated.

Herein, a congestion degree detection method of a base station by the wireless communication device **300** will be described. As a method that the wireless communication device **300** detects the congestion degree of a base station, it is possible to use a correlation detection value obtained by a

process of cell search and peripheral cell search performed in a standby time, or cell re-selection in a case of W-CDMA type. In addition, in a case of the OFDMA, it is possible to detect the congestion degree of a base station by detection information on a ratio of the number of subcarriers that is actually assigned to the total number of subcarriers per frame.

Furthermore, based on an SIR (Signal to Interference Ratio) when the wireless communication device **300** receives a pilot signal or a synchronization signal that a base station transmits, it is possible to compute a predicted maximum communication rate when the base station is used. Moreover, it is possible to obtain a predicted communication rate in addition to the congestion degree.

In addition, in a system after HSDPA type used in the third generation mobile telephone, a technique called AMC (Adaptive Modulation and Coding) has been adopted. A base station transmits a signal with a higher-level modulation system and higher code rate to a wireless communication device in a good reception state.

A case is assumed, for example, in which a service with the same communication rate is provided for a wireless communication device present at a position relatively close to a base station and a wireless communication device present at a position relatively far from a base station. In this case, the number of resources assigned to the wireless communication device present at the position relatively close to the base station may be smaller than the resources assigned to the wireless communication device present at the position relatively far from the base station. Thus, it is desirable to perform the selection of a base station (communication carrier (wireless communication network)) based on a value obtained by correcting the above-described predicted communication rate or the congestion degree with information relating to the distance from the base station. Accordingly, it is possible to further reduce a burden loaded on the base station in comparison to a case where a base station (communication carrier (wireless communication network)) is selected based on the congestion degree. This example will be shown in a second embodiment of the present disclosure.

Furthermore, a method of computing the distance between a base station from path-loss, a reception level of a pilot signal, an SIR of a synchronization signal, acquired positional information, or the like, as information relating to the distance from a base station is considered. In other words, the control unit **330** computes the distance between the wireless communication device **300** and a base station based on path-loss, a reception level of a pilot signal, an SIR of a synchronization signal, or acquired positional information. In addition, the wireless communication device **300** can predict communication cost expected based on the congestion degree of a base station.

[Configuration Example of Information Processing Device]

FIG. **3** is a block diagram showing a functional configuration example of the information processing device **200** according to the first embodiment of the present disclosure.

The information processing device **200** includes a communication unit **211**, a communication service type determination unit **212**, a congestion degree information retaining unit **220**, a communication cost information retaining unit **230**, and a wireless communication device information retaining unit **240**. In addition, the information processing device **200** includes a connection number calculation unit **250**, a connection permission determination unit **260**, a threshold value retaining unit **261**, a USIM information rewriting control unit **270**, and an execution waiting list retaining unit **280**.

The communication unit **211** receives information transmitted from each wireless communication device (for example, a connection permission request, or the congestion degree) through the first and the second network control devices **120** and **140**. Then, the communication unit **211** outputs the information to each unit. In addition, the communication unit **211** transmits information output from each unit of the information processing device **200** to each wireless communication device through the first and the second network control devices **120** and **140**.

The communication service type determination unit **212** determines the type of a communication service in relation to a connection permission request using control information included in the connection permission request transmitted from each wireless communication device and outputs the determination result to the connection permission determination unit **260**. A method of determining the type of a communication service will be described in detail with reference to FIGS. **7**A and **7**B.

The congestion degree information retaining unit **220** is a retaining unit that retains information on the congestion degree (congestion degree information). In addition, the congestion degree information retaining unit **220** supplies the retained information (congestion degree information) to each wireless communication device through each unit and the communication unit **211** of the information processing device **200**. In addition, the congestion degree information retaining unit **220** may retain a predicted communication rate in addition to the congestion degree information. Herein, the information on the congestion degree may take a form of collecting information detected by each wireless communication device, or a form of acquiring information on the congestion degree of each base station from the first and the second network control devices **120** and **140**. Furthermore, the retained content of the congestion degree information retaining unit **220** will be described in detail with reference to FIG. **4**.

The communication cost information retaining unit **230** is a retaining unit that retains information on communication cost. In addition, the communication cost information retaining unit **230** supplies the retained information (information on communication cost) to each wireless communication device through each unit and the communication unit **211** of the information processing device **200**. The retained content of the communication cost information retaining unit **230** will be described in detail with reference to FIG. **5**.

Herein, the communication unit **211** acquires the congestion degree information from each wireless communication device through the first and the second network control devices **120** and **140**, and causes the congestion degree information retaining unit **220** to retain the acquired information. In addition, the communication unit **211** acquires the information on communication cost from the first and the second network control devices **120** and **140**, and causes the communication cost information retaining unit **230** to retain the acquired information. In addition, the communication unit **211** periodically or non-periodically acquires information on communication cost from the first and the second network control devices **120** and **140**, and sequentially updates the information retained in the congestion degree information retaining unit **220** and the communication cost information retaining unit **230**. As a method of dynamically retaining the congestion degree or the predicted communication rate, for example, the information processing device **200** can be configured to receive information from each base station. In addition, it may be configured that information of the congestion degree or the predicted communication rate that a plurality of wireless communication devices in a standby time

detects is appropriately collected in relation to positional information or information on a base station (for example, a cell ID).

Herein, as the information of the congestion degree or the predicted communication rate, information acquired from the plurality of wireless communication devices and averaged can be used. In such a case, the frequency of transmitting the information of the congestion degree or the predicted communication rate from a wireless communication device can be changed according to the distance between the base station and the wireless communication device. For example, according to the shortening distance between each wireless communication device and each base station, it is possible to increase the frequency of transmitting the congestion degree detected by each of the plurality of wireless communication devices to the information processing device **200**. On the other hand, according to the lengthening distance between each wireless communication device and each base station, it is possible to reduce the frequency of transmitting the congestion degree detected by each of the plurality of wireless communication devices to the information processing device **200**.

For example, when the congestion degree is detected at a cell edge, or the like that is relatively far from a base station, a reception signal intensity from the base station is low, and therefore, the influence of an NF (Noise Figure) of a reception circuit is great, and accordingly, a greater value than the actual congestion degree (a value of relative congestion) is detected. For this reason, when the information on the congestion degree received from the plurality of wireless communication devices is averaged in the information processing device **200**, the reliability of information on the congestion degree collected from a wireless communication device present at a position relatively close to a base station is determined to be high. On the other hand, the reliability of information on the congestion degree collected from a wireless communication device present at a position relatively far from a base station is determined to be low. In addition, when the averaged information is used as the information on the congestion degree or the predicted communication rate, a weighted coefficient according to the distance from a base station (weighting according to the determination result) is used. In addition, the weighting according to the determination result can be realized by changing the frequency of transmitting the information on the congestion degree from a wireless communication device.

In addition, it is possible to cut reception power by controlling the transmission frequency as above. For example, a wireless communication device at a position relatively far from a base station has to perform transmission with increased transmission power. For this reason, by lowering such transmission frequency from the wireless communication device, it is possible to cut power consumption of the wireless communication device.

In addition, the transmission frequency may be set to be controlled according to remaining charge amounts of a battery (a battery (not shown in the drawing) that is built or loaded in the wireless communication device **300**) for driving the wireless communication device **300**. For example, the control unit **330** of the wireless communication device **300** can control the transmission frequency according to the above-described distance between the wireless communication device and the base station and control the transmission frequency according to a remaining battery amount. When the battery has a large amount of remaining charged power, for example, the control unit **330** increases the transmission frequency, and when the battery has a little amount of remaining charged power, the control unit controls to lower the transmission frequency. Accordingly, it is possible to realize tradeoff by improving information collection efficiency of the information processing device **200** and using the battery of the wireless communication device **300** for a long period of time. As such, since the portable wireless communication device **300** performs operations mostly using the battery, it is important to reduce power consumption by efficiently using the battery.

The wireless communication device information retaining unit **240** is a retaining unit that retains information on each wireless communication device (wireless communication device information). In addition, the wireless communication device information retaining unit **240** supplies the retained information (wireless communication device information) to each unit of the information processing device **200**. The retained content of the wireless communication device information retaining unit **240** will be described in detailed with reference to FIG. **6**A.

The connection number calculation unit **250** calculates the number of wireless communication devices that are connected to a base station relating to a connection permission request transmitted from each wireless communication device based on the retained content of the wireless communication device information retaining unit **240**. Then the connection number calculation unit **250** outputs the calculated number of wireless communication devices to the connection permission determination unit **260**.

The connection permission determination unit **260** determines whether or not to permit the connection permission request when the connection permission request is transmitted from each wireless communication device, and outputs the determination result to the USIM information rewriting control unit **270**. For example, the connection permission determination unit **260** determines whether or not to permit the connection permission request based on the number of wireless communication devices calculated by the connection number calculation unit **250** (connection information). Specifically, the connection permission determination unit **260** determines whether or not to permit the connection permission request based on a comparison result between the number of wireless communication devices calculated by the connection number calculation unit **250** and a threshold value retained in the threshold value retaining unit **261**. For example, when the number of wireless communication devices is lower than the threshold value, it is determined to permit the connection permission request, and when the number of wireless communication devices is higher than the threshold value, it is determined not to permit the connection permission request. In addition, when it is determined not to permit the connection permission request, the connection permission determination unit **260** outputs the intent to the communication unit **211** so as to cause the wireless communication device to display the intent. Furthermore, the connection permission determination unit **260** is an example of the determination unit described in the claims.

The threshold value retaining unit **261** is a unit retaining a threshold value used in the determining process by the connection permission determination unit **260**, and supplies the retained threshold value to the connection permission determination unit **260**.

The USIM information rewriting control unit **270** controls to set a connection right (connection right based on USIM information) to be connected to the base station relating to the connection permission request in the wireless communication device that transmits the connection permission request when the connection permission determination unit **260**

determines to permit the request. In addition, when a communication service through the base station relating to the connection permission request ends after setting the connection right, the USIM information rewriting control unit **270** controls to set the first connection right to the wireless communication device (restoration process). In other words, the USIM information rewriting control unit **270** performs a rewriting process and a restoration process of USIM information for the target wireless communication device. In addition, the USIM information rewriting control unit **270** causes the wireless communication device information retaining unit **240** to retain information on the wireless communication device that has undergone the rewriting process of the USIM information. In addition, after performing the restoration process, the USIM information rewriting control unit **270** deletes the information on the wireless communication device from the wireless communication device information retaining unit **240**. Furthermore, the USIM information rewriting control unit **270** is an example of a control unit described in the claims.

The execution waiting list retaining unit **280** is a unit retaining the information on the wireless communication device that has transmitted the connection permission request when the determination process is performed by the connection permission determination unit **260** after a fixed period of time passes.

[Content Example of Congestion Degree Information Storage Unit]

FIG. **4** is a diagram schematically showing an example of stored content of the congestion degree information retaining unit **220** according to the first embodiment of the present disclosure.

The congestion degree information retaining unit **220** is a retaining unit that retains information on the congestion degree of each base station (congestion degree information). Specifically, a cell ID **221**, positional information **222**, and congestion degree information **223** are retained in the congestion degree information retaining unit **220** in relation to each communication carrier.

The cell ID **221** is identification information for identifying a base station (cell) that a communication carrier operates.

The positional information **222** is information on a position where a base station operated by a communication carrier is present. As the positional information **222**, for example, the latitude and the longitude corresponding to the position where each base station is present are stored.

The congestion degree information **223** is information on the congestion degree of a base station operated by a communication carrier. As the congestion degree information **223**, for example, a value of 0 to 1 is stored. In FIG. **4**, the congestion degree of the value "1" is the highest (in other words, congested) and the congestion degree of the value "0" is the lowest (in other words, not congested) in the congestion degree information **223**.

In addition, for the sake of simple description in FIG. **4**, each piece of information on each base station of which the range of the cell overlaps among cells of base stations operated by each communication carrier is arranged and shown in the same row.

[Content Example of Communication Cost Information Retaining Unit]

FIG. **5** is a diagram schematically showing an example of the retained content of the communication cost information retaining unit **230** according to the first embodiment of the present disclosure.

A cell ID **231**, time information **232**, congestion degree information **233**, and communication cost per packet **234** are retained in the communication cost information retaining unit **230** correspondingly.

The cell ID **231** is identification information for identifying a base station (cell) operated by a communication carrier. With the cell ID **231**, a position where a base station operated by a communication carrier is present is specified.

The time information **232** is information indicating time zones with a predetermined interval.

The congestion degree information **233** is information on the congestion degree of a base station operated by a communication carrier. As the congestion degree information **233**, for example, values of 0 to 1 are stored. In FIG. **5**, the congestion degree of the value "1" is the highest (in other words, congested) and the congestion degree of the value "0" is the lowest (in other words, not congested) in the congestion degree information **233**.

The communication cost per packet **234** is information on communication cost charged when a wireless communication device uses a wireless connection service through a communication carrier (communication cost information). In other words, communication cost information of a communication carrier relating to the USIM information (USIM information after rewriting) retained in a wireless communication device is stored. Furthermore, in regard to the communication cost information, it is possible to dynamically change a stage of the congestion degree at which the communication cost changes.

For example, it is assumed that, at the time of 11 o'clock, the congestion degree information **233** corresponding to the cell ID **231** "0001" is "0.30" and the congestion degree information corresponding to the cell ID **231** "0077" is "0.10". In this case, when the communication cost is to be acquired at each area at the time of 11 o'clock, the communication cost "0.18 Yen" is acquired in the cell ID **231** "0001" and the communication cost "0.15 Yen" is acquired in the cell ID **231** "0077".

In addition, such a charging process is performed based on the retained content of the communication cost information retaining unit **230** for a wireless communication device that has received the permission for the connection permission request through the determination by the connection permission determination unit **260** and has been set with the connection right by the USIM information rewriting control unit **270**. In this case, the communication cost when the base station is used is sequentially updated according to the congestion degree and the predicted communication rate of the base station. Accordingly, it is possible to realize a charging method that changes the communication costs in accordance with the demand and the supply of communication resources.

[Content Example of Wireless Communication Device Information Retaining Unit]

FIG. **6**A is a diagram schematically showing an example of the retained content of the wireless communication device information retaining unit **240** according to the first embodiment of the present disclosure.

The wireless communication device information retaining unit **240** is a retaining unit that retains information on each wireless communication device (wireless communication device information). Specifically, the wireless communication device information retaining unit **240** retains terminal identification information **241**, a cell ID **242**, and a connection-permitting communication carrier **243** in relation to each wireless communication device.

The terminal identification information **241** is identification information for identifying each wireless communication device.

The cell ID **242** is identification information for identifying a base station (cell) operated by a communication carrier.

The connection-permitting communication carrier **243** is information of a connection-permitting communication carrier for the wireless communication device that transmitted the connection permission request. For example identification information for identifying the communication carrier is stored therein. Furthermore, for the sake of simple description in FIG. **6**A, only the names of the communication carriers are shown as the identification information for identifying the communication carriers.

Furthermore, in FIG. **6**A, the wireless communication device information retaining unit **240** may retain information other than the information shown in FIG. **6**A even though description and graphic display thereof are omitted. For example, the wireless communication device information retaining unit can retain information on the position in the zone where the wireless communication device is present, time-series information on the position in the zone where the wireless communication device is present (for example, movement history information), and information on the area code of the zone where the wireless communication device is present. In addition, the wireless communication device information retaining unit can retain information on the base station in the zone where the wireless communication device is present, and identification information assigned to individual access points in the zone where the wireless communication device is present. In addition, the wireless communication device information retaining unit can retain time-series information on the reception signal intensity and the pilot signal (or the reference signal) reception intensity (in other words, history information of each intensity) at the position in the zone where the wireless communication device is present. In addition, the wireless communication device information retaining unit can retain information on peripheral base stations detected by the wireless communication device, information on the congestion degree of the base station detected by the wireless communication device, and information on the battery of the wireless communication device. In addition, the wireless communication device information retaining unit can retain character information input by a user through an input device (for example, the operation reception unit **340**) of the wireless communication device (for example, including log information relating to life-log). In addition, the wireless communication device information retaining unit can retain information including at least one out of the above. In addition, information to be retained (predetermined information) as above is sequentially transmitted from each wireless communication device, as described above.

Herein, the content of information (predetermined information) transmitted from the wireless communication device **300** to the information processing information **200** to make the wireless communication device information retaining unit **240** retain can be dynamically changed. In other words, the control unit **330** of the wireless communication device **300** can change the content included in the predetermined information. For example, in a period where the wireless communication device **300** uses the communication service based on the code division multiplexing access scheme, only the time-series information on the position in the zone where the wireless communication device is present can be transmitted among the above-described information. In addition, in a period where the wireless communication device **300** uses the communication service based on the orthogonal frequency division multiple access scheme, the information on the peripheral base stations of the wireless communication device **300** can be transmitted in addition to the time-series information on the position in the zone where the wireless communication device is present. Furthermore, such transmission control as above is an example, and information to be transmitted can be appropriately changed. As such, the control unit **330** can change the content included in the predetermined information based on the type of the communication system that the wireless communication device **300** uses. Herein, the type of the communication system includes, for example, the code division multiplexing access scheme or the orthogonal frequency division multiple access scheme.

In addition, the content of information (predetermined information) transmitted from the wireless communication device **300** to the information processing information **200** to make the wireless communication device information retaining unit **240** retain can be dynamically changed according to the remaining amount of battery power that drives the wireless communication device **300**. In other words, the control unit **330** can change the content included in the predetermined information. In a state where the remaining amount of battery power is small, for example, it is possible to selectively transmit the content of the predetermined information as a transmission target so that the volume of the predetermined information as the transmission target is small. As such, the control unit **330** can change the content included in the predetermined information based on the remaining amount of battery power that drives the wireless communication device **300**.

In addition, the information processing device **200** may periodically or non-periodically process information retained in the wireless communication device information retaining unit **240**. For example, an index on interference computed based on the reception signal intensity, the pilot signal reception intensity or the reference signal reception intensity, and the information on the peripheral base stations may be saved in relation to a position corresponding to a grid obtained by dividing geographical features in lattice shapes. In this case, a wireless communication device information retaining unit **245** retains each piece of the information in relation to a position specified based on the predetermined information (positional information) including the above pieces of information. The retention example is shown in FIG. **6**B.

FIG. **6**B is a diagram schematically showing an example of the retained content of the wireless communication device information retaining unit **245** according to the first embodiment of the present disclosure. Furthermore, the wireless communication device information retaining unit **245** is a modified example of the wireless communication device information retaining unit **240**, and FIG. **6**B shows content other than the retained content of the wireless communication device information retaining unit **240**.

The wireless communication device information retaining unit **245** retains each piece of information in relation to positional information (latitude **246** and longitude **247**). For example, time-series information **248** on the reception signal intensity at the position in the zone where each wireless communication device is present and the reception intensity of the pilot signal or the reference signal, and an index **249** relating to the interference computed based on the peripheral base stations detected by each wireless communication device are retained.

The positional information (latitude **246** and longitude **247**) is information on a position corresponding to a grid obtained by dividing geographical features in lattice shapes.

In this way, the information processing device **200** can configure the wireless communication device information retaining unit **245** as a database serving as a type of reception quality map. Further, the information processing device **200** can provide the reception quality to each of the wireless communication device using the wireless communication device information retaining unit **245**.

The wireless communication device **300** transmits, for example, an acquisition request on information regarding the reception quality (including information regarding the position in the zone where the wireless communication device **300** is present) to the information processing device **200**. When the acquisition request is received, the communication unit **211** of the information processing device **200** transmits to the wireless communication device **300** each piece of the information of the wireless communication device information retaining unit **245** relating to the position in the zone where the wireless communication device **300** is present. In other words, the reception signal intensity of the position in the zone where the wireless communication device **300** is present, the reception intensity of the pilot signal or the reference signal, and the index relating to interference can be transmitted to the wireless communication device **300**. Furthermore, the inquiry (acquisition request) can be made by the wireless communication device **300** using wireless communication via a base station. In addition, the inquiry (acquisition request) can be made by the wireless communication device **300** using wired communication. In addition, as a method of periodically processing the information on the reception quality (the reception signal intensity and the like) retained in the wireless communication device information retaining unit **245**, it is possible to use a method of averaging the information, for example, on hourly, daily, weekly, or monthly basis, or the like. In addition, a method of averaging the information by increasing the weight of the latest information, or the like may be used.

[Determination Example of Communication Service Type]

FIGS. **7**A and **7**B are diagrams schematically showing a determination example when the communication service type determination unit **212** determines the type of a communication service according to the first embodiment of the present disclosure.

FIG. **7**A schematically shows the flow of a connection request **150** when the user of the wireless communication device **300** requests the desired communication service.

FIG. **7**B schematically shows a case where the communication service type determination unit **212** determines the type of a communication service relating to the connection request **150**, using control information **151** included in the connection request **150** shown in FIG. **7**A.

The control information **151** includes, for example, connection point information **152**, a protocol **153**, and a port number **154**. In addition, the communication service type determination unit **212** acquires the control information **151** included in the connection request **150** and sorts the type of a communication service relating to the connection request **150** based on at least one piece of the control information **151**.

FIG. **7**B shows an example in which determination is made by sorting the type of the communication service relating to the connection request **150** into two, which are a continuously provided communication service **161** and an intermittently provided communication service **162**.

Herein, the continuously provided communication service **161** includes, for example, a streaming service, an Internet browsing service including moving images, and a downloading service of moving image files. In addition, the intermittently provided communication service **162** includes, for example, web browsing, e-mail transmission and reception, and a search service.

Furthermore, FIG. **7**B shows the example in which the type of the communication service relating to the connection request **150** is sorted into two, but the continuously provided communication service **161** and the intermittently provided communication service **162** may be more finely sorted. For example, the continuously provided communication service **161** can be sorted into plural sub-types such as a further continuously provided service and a service close to the intermittently provided communication service **162**. In addition, the intermittently provided communication service **162** can be sorted into plural sub-types such as a further intermittently provided communication service and a service close to the continuously provided communication service **161**.

In addition, it may be possible to perform sorting into types other than the continuously provided communication service **161** and the intermittently provided communication service **162**. For example, the sorting can be performed in plural types such as a communication service for immediate use and a communication service that is not necessary to be immediately used. In addition, it is possible to sort into plural types such as a communication service with high urgency and a communication service with low urgency.

Furthermore, as a determination method of determining the type of a communication service, other determination methods may be used. For example, a signal configuration is retained in advance between the wireless communication device **300** and the information processing device **200** so as to sort the type of a communication service. Then, when a connection permission request is transmitted from the wireless communication device **300**, the connection permission request may be transmitted including a signal for sorting the type of the communication service, and then the type of the communication service may be informed to the information processing device **200** from the wireless communication device **300**. Accordingly, the information processing device **200** can determine the type of the communication service.

[Example on Communication Between Each Device]

FIGS. **8** and **9** are sequence charts showing a communication processing example between each device constituting the communication system **100** according to the first embodiment of the present disclosure. FIGS. **8** and **9** only show a communication processing example between the wireless communication device **300** and the information processing device **200**, but the sequence can be applied in the same manner to a communication process between other wireless communication devices and the information processing device **200**.

In addition, FIGS. **8** and **9** show an example of a rewriting process and a restoration process for USIM information when the wireless communication device **300** retains the USIM information pertaining to the first communication carrier. In addition, FIGS. **8** and **9** describe an example case where the user of the wireless communication device **300** wants to use a communication service with a high communication rate.

First, a communication service start operation for getting the communication service that the user wants is performed using the wireless communication device **300** (**401**). The communication service start operation is performed by a selection operation for selecting the communication service that the user wants when, for example, a communication service operation screen is displayed on the display unit **350**.

When a communication service start process is performed, the control unit **330** acquires from the congestion degree information storage unit **380** the congestion degree informa-

tion relating to a plurality of base stations connectable at the position where the wireless communication device **300** is present (**402**). Then, the control unit **330** selects a base station (communication carrier (wireless communication network)) with the lowest congestion degree from the plurality of base stations relating to the acquired congestion degree information (**403**). For example, the cell ID of the base station with the lowest congestion degree (for example, the ID corresponding to the cell ID **221** shown in FIG. **4**) is selected. In this example, description will be provided assuming that the selected base station is a base station operated by the second communication carrier. Furthermore, when the selected base station is a base station operated by a communication carrier having a contract with the user of the wireless communication device **300**, a connection process based on the USIM information retained in the wireless communication device **300** is performed without performing processes thereafter. Furthermore, instead of the congestion degree, a communication carrier may be selected based on the predicted communication rate.

Subsequently, the connection permission request for using the selected base station (communication carrier) is transmitted to the information processing device **200** from the wireless communication device **300** through the first network control device **120** (**404** to **407**). The connection permission request is a connection request for receiving the communication service that the user wants. In addition, the connection permission request includes information on the wireless communication device **300** (for example, retained USIM information and terminal identification information), information on the selected base station (communication carrier), and information on the selection reference (selection reference information (such as the congestion degree, communication cost, and the like)). As such, the connection permission request is transmitted through the communication carrier with which the user of the wireless communication device **300** has the contract in advance.

If the connection permission request is received from the wireless communication device **300** (**407**), the information processing device **200** performs a connection permission determination process (**408**). In other words, the connection number calculation unit **250** calculates the number of wireless communication devices (the number of connections) that are connected to the base station relating to the connection permission request based on the content of the wireless communication device information retaining unit **240**. Subsequently, the connection permission determination unit **260** compares the calculated number of connections and the threshold value retained in the threshold value retaining unit **261** and determines whether or not to permit the connection of the wireless communication device **300** that has transmitted the connection permission request based on the comparison result. For example, when the calculated number of connections is less than the threshold value, it is determined to permit the connection of the wireless communication device **300** that has transmitted the connection permission request to the base station relating to the connection permission request. On the other hand, when the acquired number of connections is equal to or higher than the threshold value, it is determined not to permit the connection of the wireless communication device **300** that has transmitted the connection permission request to the base station relating to the connection permission request.

Furthermore, when it is determined not to permit the connection to the base station relating to the connection permission request, for example, the intent is transmitted to the wireless communication device **300** that has transmitted the connection permission request, and the intent is displayed on the display unit **350**. The display example is shown in FIG. **10**A. In addition, when it is determined not to permit the connection to the base station relating to the connection permission request, for example, the intent of promoting the selection of other communication carrier is transmitted to the wireless communication device **300** that has transmitted the connection permission request, and the intent is displayed on the display unit **350**. The display example is shown in FIG. **10**B. In this case, a new base station (communication carrier) is selected by a user operation.

Furthermore, as the threshold value used in the determination process by the connection permission determination unit **260** (threshold value retained in the threshold value retaining unit **261**), a fixed value may be used, or a value changed based on the predicted communication rate or the congestion degree that is periodically or non-periodically updated may be used.

Subsequently, if the connection of the wireless communication device **300** is permitted by the connection permission determination process (**408**), connection permission indicating the intent of permitting the connection is transmitted from the information processing device **200** to the wireless communication device **300** through the first network control device **120** (**409** to **412**). The connection permission includes information for rewriting the USIM information stored in the USIM information storage unit **370** of the wireless communication device **300** (for the first communication carrier) to USIM information for being connected to the second network control device **140** (for the second communication carrier). In addition, the USIM information rewriting control unit **270** records terminal identification information on the wireless communication device **300** that has transmitted the connection permission and information on the base station that the device connects (including the cell ID, the communication carrier, or the like) to the wireless communication device information retaining unit **240**.

As such, when the connection permission is transmitted from the information processing device **200** to the wireless communication device **300**, information on the wireless communication device **300** to which the connection permission is transmitted is recorded in the wireless communication device information retaining unit **240**. As the wireless communication device is close to the base station, a burden on resources of the base station is low even if the service is provided at the same communication rate. Thus, when the retained content of the wireless communication device information retaining unit **240** is updated, weighting is performed according to a predicted communication rate of the wireless communication device **300** that has given the connection permission, and the weight may be recorded. An example of recording the weight will be described in a second embodiment of the present disclosure.

In addition, if the wireless communication device **300** receives the connection permission (**412**), the USIM information rewriting unit **360** of the wireless communication device **300** rewrites the USIM information stored in the USIM information storage unit **370** based on the connection permission (**413**). In other words, the USIM information relating to the first communication carrier is rewritten to the USIM information relating to the second communication carrier. With the rewriting process, the wireless communication device **300** can be connected to the second communication carrier (the second network control device **140**).

As such, when the rewriting process of the USIM information has been performed, the fact that the rewriting process of the USIM information has been performed may be displayed on the display unit **350**. For example, the display can be realized by causing the display unit **350** to display the name of

the communication carrier in connecting in an area. Accordingly, the user who owns the wireless communication device **300** can easily grasp that the rewriting process of the USIM information has been performed.

Subsequently, when the rewriting process of the USIM information is completed (**413**), the control unit **330** of the wireless communication device **300** transmits the connection request to the second network control device **140** (**414** and **415**). In other words, the connection request is transmitted to the second communication relating to the base station through the base station selected based on the congestion degree information (base station with the lowest congestion degree).

When the connection request is received (**415**), the second network control device **140** performs a connection process between the wireless communication device **300** (**416** and **417**). With the connection process, the wireless communication device **300** can communicate with the second network control device **140**. For this reason, the wireless communication device **300** can receive the communication service that the user wants through the second network control device **140**. In other words, the communication service that the user wants can be provided to the wireless communication device **300** using the wireless connection network of the second communication carrier.

In addition, when the process of providing the communication service from the information processing device **200** to the wireless communication device **300** is completed (**421**), USIM information restoration instruction information is transmitted (**422** to **425**). In other words, when the provision of the communication service that the user wants is completed (**421**), the USIM information restoration instruction information is transmitted from the information processing device **200** to the wireless communication device **300** through the second network control device **140** (**422** to **425**). The USIM information restoration instruction information includes information for rewriting USIM information stored in the USIM information storage unit **370** of the wireless communication device **300** (for the second communication carrier) to the USIM information relating to the first communication carrier (restoration information).

In addition, if the wireless communication device **300** receives the USIM information restoration instruction information (**425**), the USIM information rewriting unit **360** of the wireless communication device **300** rewrites the USIM information stored in the USIM information storage unit **370** based on the USIM information restoration instruction information (**426**). In other words, the USIM information relating to the second communication carrier is rewritten to the USIM information relating to the first communication carrier. With the restoration process, the wireless communication device **300** can be connected to the first communication carrier (the first network control device **120**).

[Display Example of Connection Non-Permission]

FIGS. **10**A and **10**B are diagrams showing a display screen example displayed in the wireless communication device **300** according to the first embodiment of the present disclosure.

FIG. **10**A shows a display example (display screen **170**) displayed on the display unit **350** when it is determined not to permit the connection to the base station relating to the connection permission request, as a result of the connection permission determination process by the connection permission determination unit **260**. For example, when the display screen **170** is displayed on the display unit **350**, the user presses down an OK button **171** and then can perform the communication service start operation for receiving the communication service using the current USIM information.

FIG. **10**B shows a display example (display screen **172**) displayed on the display unit **350** when it is determined not to permit the connection to the base station relating to the connection permission request, as a result of the connection permission determination process by the connection permission determination unit **260**.

The display screen **172** displays connection buttons **173** and **174**, and a return button **175** for selecting other communication carriers. The connection buttons **173** and **174** are displayed, for example, in order of the base stations with low congestion degrees.

For example, when the connection button **173** or **174** of a communication carrier that the user wants is pressed down, a connection permission request for using the communication carrier of which the button is pressed down is transmitted from the wireless communication device **300** to the information processing device **200** through the first network control device **120**. Accordingly, as shown in FIGS. **8** and **9**, the connection process is performed. Furthermore, when the return button **175** is pressed down, other operation screen is displayed.

[Operation Example of Wireless Communication Device]

Next, the operation of the wireless communication device **300** according to the first embodiment of the present disclosure will be described with reference to the drawings.

FIG. **11** is a flowchart showing an example of a processing procedure of a communication service control process by the wireless communication device **300** according to the first embodiment of the present disclosure.

First, the communication service operation screen for performing the communication service start operation for receiving the communication service that the user wants is displayed on the display unit **350** (Step S**901**). In the communication service operation screen, it is determined whether or not the communication service start operation by the user has been performed (Step S**902**), and when the communication service start operation has not been performed, monitoring is continued.

When the communication service start operation has been performed (Step S**902**), the control unit **330** acquires congestion degree information relating to the plurality of base stations connectable at the position where the wireless communication device **300** is present from the congestion degree information storage unit **380** (Step S**903**). Subsequently, the control unit **330** selects a base station (communication carrier) with the lowest congestion degree out of the plurality of base stations relating to the acquired congestion degree information (Step S**904**). Furthermore, when the selected base station is the base station operated by the first communication carrier having a contract with the user of the wireless communication device **300**, the connection process is performed based on the USIM information retained in the wireless communication device **300** without performing processes thereafter.

Subsequently, the control unit **330** transmits a connection permission request for using the selected base station (communication carrier) to the information processing device **200** through the first network control device **120** (Step S**905**).

Subsequently, it is determined whether or not connection permission indicating that the connection to the base station relating to the connection permission request is permitted has been received (Step S**906**). Then, when the connection permission has not been received (Step S**906**), it is determined whether or not the intent that the connection to the base station relating to the connection permission request is not permitted has been received (Step S**911**), and when the intent of not permitting the connection has not been received, the

process returns to Step S906. On the other hand, when the intent of not permitting the connection to the base station relating to the connection permission request has been received (Step S911), the intent is displayed on the display unit 350 (Step S912), and the operation of the communication service control process ends. Furthermore, Step S912 is an example of a display procedure described in the claims.

When the connection permission has been received (Step S906), the USIM information rewriting unit 360 rewrites the USIM information stored in the USIM information storage unit 370 based on the connection permission (Step S907).

Subsequently, the control unit 330 transmits a connection request to the communication carrier (network control device) relating to the rewritten USIM information, and a connection process is performed between the network control device and the wireless communication device 300 (Step S908). After the connection process, the communication service that the user wants is performed between the network control device and the wireless communication device 300.

Subsequently, it is determined whether or not USIM information restoration instruction information indicating that the process of providing the communication service is completed has been received (Step S909), and when the USIM information restoration instruction information has not been received, monitoring is continued. When the USIM information restoration instruction information has been received (Step S909), the USIM information rewriting unit 360 rewrites the USIM information stored in the USIM information storage unit 370 based on the USIM information restoration instruction information (Step S910). In other words, the restoration process of the USIM information is performed.

[Operation Example of Information Processing Device]

Next, the operation of the information processing device 200 according to the first embodiment of the present disclosure will be described with reference to drawings.

[Operation Example when Connection not Permitted is to be Displayed]

FIG. 12 is a flowchart showing an example of a processing procedure of a USIM information rewriting control process by the information processing device 200 according to the first embodiment of the present disclosure. In this example, when the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request is equal to or higher than a threshold value, an example is shown in which the intent of not permitting the connection to the base station relating to the connection permission request is displayed on the wireless communication device.

First, it is determined whether or not the connection permission request from the wireless communication device has been received (Step S915), and when the connection permission request has not been received, monitoring is continued. When the connection permission request has been received (Step S915), the connection permission determination unit 260 performs a connection permission determination process (Step S916). In other words, the connection permission determination unit 260 acquires the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request from the connection number calculation unit 250, and compares the acquired number of connections to the threshold value (Step S916). Furthermore, Step S916 is an example of the determination procedure described in the claims.

When the number of connections is less than the threshold value (Step S916), the USIM information rewriting control unit 270 transmits the connection permission indicating the intent of permitting the connection to the base station relating to the connection permission request to the wireless communication device that transmitted the connection permission request (Step S917). In this case, the connection permission is transmitted through the network control device relating to the USIM information retained in the wireless communication device that transmitted the connection permission request. In addition, the USIM information rewriting control unit 270 records terminal identification information relating to the wireless communication device 300 to which the connection permission is transmitted and information on the base station to which the device is connected (the cell ID, the communication carrier, or the like) onto the wireless communication device information retaining unit 240. Furthermore, Step S917 is an example of a setting procedure described in the claims.

Subsequently, it is determined whether or not the connection of the wireless communication device after rewriting of the USIM information (the process of providing the communication service) has been completed (Step S918), and when the process of providing the communication service has not been completed, monitoring is continued. On the other hand, when the process of providing the communication service has been completed (Step S918), the USIM information rewriting control unit 270 transmits the USIM information restoration instruction information to the wireless communication device for which the process of providing the communication service has been completed (Step S919).

In addition, when the number of connections is equal to or higher than the threshold value (Step S916), the intent of not permitting the connection to the base station relating to the connection permission request is transmitted to the wireless communication device that transmitted the connection permission request (Step S920). Accordingly, the intent of not permitting the connection to the base station relating to the connection permission request is displayed on the wireless communication device. Furthermore, Step S920 is an example of a display procedure described in the claims.

As such, when the number of connections to the base station relating to the connection permission request reaches the threshold value, the intent of not permitting the connection is notified to the user, and therefore, the user can easily grasp the intent.

[Operation Example in Connection to Other Base Stations]

FIG. 13 is a flowchart showing an example of the processing procedure of the USIM information rewriting control process by the information processing device 200 according to the first embodiment of the present disclosure. This example shows that, when the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request is equal to or higher than the threshold value, the wireless communication device is connected to other base station. In addition, since the processing procedure is of a modified example of FIG. 12, the same reference numerals are given to the portions common to those in FIG. 12, and description thereof is omitted.

When the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request is equal to or higher than the threshold value (Step S916), the connection permission determination unit 260 selects a new candidate based on the content of the congestion degree information retaining unit 220 (Step S921). In other words, the connection permission determination unit 260 selects as a new candidate a base station (communication carrier) with the next lowest congestion degree from the plurality of base stations connectable at

the position where the wireless communication device that transmitted the connection permission request is present (Step S921).

Subsequently, it is determined whether or not the selected base station as a new candidate is a base station operated by the communication carrier having a contract with the user of the wireless communication device that transmitted the connection permission request (Step S922). In other words, it is determined whether or not the base station selected as a new candidate is connectable to the wireless communication device that transmitted the connection permission request (Step S922). When the base station selected as a new candidate is connectable to the wireless communication device that transmitted the connection permission request (Step S922), the operation of the USIM information rewriting control process ends. In this case, for example, the intent is transmitted to the wireless communication device.

When the base station selected as a new candidate is not connectable to the wireless communication device that transmitted the connection permission request (Step S922), the connection permission determination unit **260** performs a connection permission determination process (Step S923). In other words, the connection permission determination unit **260** acquires the number of wireless communication devices (the number of connections) connected to the base station selected as a new candidate from the connection number calculation unit **250**, and compares the acquired number of connections to a threshold value (Step S923).

When the number of connections is less than the threshold value (Step S923), the USIM information rewriting control unit **270** transmits connection permission indicating the intent of permitting the connection to the base station selected as a new candidate to the wireless communication device that transmitted the connection permission request (Step S924). In this case, the connection permission is transmitted through the network control device relating to the USIM information retained in the wireless communication device that transmitted the connection permission request.

On the other hand, when the number of connections is equal to or higher than the threshold value (Step S923), the process returns to Step S921, and another new candidate is selected.

As such, when the number of connections to the base station reaches the threshold value, it is possible to grant permission for connecting to a base station with the next lowest congestion degree (or a wireless communication network with the second highest predicted communication rate).

[Operation Example when Specific Communication Service is Preferentially Connected]

FIG. **14** is a flowchart showing an example of the processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. This example shows that, when a communication service relating to the connection permission request from the wireless communication device is a specific communication service, the connection relating to the connection permission request is preferentially performed. In addition, since the processing procedure is of a modified example of FIG. **12**, the same reference numerals are given to the portions common to those in FIG. **12**, and description thereof is omitted.

When the connection permission request is received from the wireless communication device (Step S915), the communication service type determination unit **212** determines the type of a communication service relating to the connection permission request (Step S930). Furthermore, Step S930 is an example of a service type determination procedure described in the claims. Subsequently, the connection permission determination unit **260** determines whether or not the type of the communication service relating to the connection permission request is a specific communication service (Step S931). Such a specific communication service is, for example, a continuously provided communication service (for example, **161** shown in FIG. **7**B). When the type of the communication service relating to the connection permission request is the specific communication service (Step S931), the process advances to Step S916.

When the type of the communication service relating to the connection permission request is not the specific communication service (Step S931), the connection permission determination unit **260** records the wireless communication device that transmitted the connection permission request in the execution waiting list retaining unit **280** (Step S933). Subsequently, it is determined whether or not a fixed time has passed (Step S934), and when the fixed time has not passed, monitoring is continued. Until the fixed time passes, the wireless communication device that transmitted the connection permission request may perform a connection process using the already-retained USIM information so as to activate the desired communication service.

When the fixed time has passed (Step S934), the connection permission determination unit **260** performs the connection permission determination process (Step S935). In other words, the connection permission determination unit **260** acquires from the connection number calculation unit **250** the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request from the wireless communication device recorded in the execution waiting list retaining unit **280**. Then the acquired number of connections and the threshold value are compared (Step S935).

When the number of connections is less than the threshold value (Step S935), the process advances to Step S917. On the other hand, when the number of connections is equal to or higher than the threshold value (Step S935), it is determined whether or not the connection permission determination process relating to the wireless communication device recorded in the execution waiting list retaining unit **280** has been performed a predetermined number of times (Step S936). When the connection permission determination process has not been performed the predetermined number of times (Step S936), the process returns to Step S934. On the other hand, when the connection permission determination process has been performed the predetermined number of times (Step S936), the intent of not permitting the connection to the base station relating to the connection permission request is transmitted to the wireless communication device that transmitted the connection permission request (Step S937).

As such, it is possible to preferentially perform the process for the wireless communication device performing the specific communication service (for example, the continuously provided communication service). In other words, it is possible to preferentially permit the wireless communication device to set the connection right to be connected to the selected base station. In addition, it may be possible to preferentially permit a wireless communication device with a high predicted communication rate to set the connection right to be connected to the selected wireless communication network.

FIG. **15** is a flowchart showing an example of a processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. This example shows that, when the communication service relating to the

connection permission request from the wireless communication device is other communication service than the specific communication service, the wireless communication device is connected to the next appropriate base station. In addition, since the processing procedure is of a modified example of FIG. **14**, the same reference numerals are given to the portions common to those in FIG. **14**, and description thereof is omitted.

When the type of the communication service relating to the connection permission request is not the specific communication service (Step **S931**), the process advances to Step **S941**. Furthermore, Steps **S941** to **S944** are substantially the same as Steps **S921** to **S924** shown in FIG. **13**. For this reason, detailed description thereof will be omitted.

As such, a wireless communication device providing the specific communication service (for example, the continuously provided communication service) can be preferentially allocated with resources of the selected wireless communication network. In addition, a wireless communication device that request a service other than the specific communication service can be permitted to set the connection right to be connected to a base station with the next lowest congestion degree in the selected wireless communication network (or a wireless communication network with the next highest predicted communication rate). Furthermore, a service other than the specific communication service is, for example, an intermittently provided communication service.

FIGS. **28** and **29** are flowcharts showing another example of a processing procedure of a USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. This example shows a case in which a wireless communication device is made to be connected to a base station corresponding to the code division multiplexing access scheme when a communication service relating to a connection permission request from the wireless communication device to a base station corresponding to the orthogonal frequency division multiple access scheme is a communication service other than a specific communication service. In addition, since the processing procedure is a modified example of FIG. **15**, the same reference numerals will be given to portions common to those in FIG. **15**, and description thereof will be omitted.

When the type of the communication service relating to the connection permission request is a specific communication service (Step **S931**), it is determined whether or not the number of connections to a base station corresponding to the orthogonal frequency division multiple access scheme relating to the connection permission request is less than a threshold value (Step **S1100**). Then, when the number of connections is less than the threshold value (Step **S1100**), the process advances to Step **S917**, and when the number of connections is equal to or greater than the threshold value (Step **S1100**), the process advances to Step **S941**. In this case, the base station corresponding to the orthogonal frequency division multiple access scheme is selected as a new candidate (Step **S941**).

In addition, when the type of the communication service relating to the connection permission request is not a specific communication service (Step **S931**), a base station corresponding to the code division multiplexing access scheme is selected as a new candidate (Step **S1101**). Subsequently, it is determined whether or not the number of connections to the base station corresponding to the code division multiplexing access scheme relating to the connection permission request is less than the threshold value (Step **S1102**). Then, when the number of connections is less than the threshold value (Step **S1102**), the process advances to Step **S917**, and when the number of connections is equal to or greater than the threshold value (Step **S1102**), the process advances to Step **S1103**. Furthermore, Steps **S1103** to **S1106** are substantially the same as Steps **S921** to **S924** shown in FIG. **13**. For this reason, detailed description thereof will be omitted herein. However, the base station corresponding to the code division multiplexing access scheme is selected as a new candidate (Step **S941**).

As such, it is possible to preferentially assign the resources of the selected wireless communication network of the orthogonal frequency division multiple access scheme to the wireless communication device using the specific communication service. Furthermore, the specific communication service is, for example, a continuously provided communication service, or a communication service provided with low-delay. In addition, it is possible to allow a wireless communication device that requests a service other than the specific communication service to set the communication right to be connected to the base station corresponding to the code division multiplexing access scheme. Furthermore, the service other than the specific communication service is, for example, an intermittently provided communication service, or a communication service provided without low-delay.

FIG. **30** is a flowchart showing another example of the processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. This example shows a case in which the wireless communication device is connected to the base station corresponding to code division multiplexing access scheme when a predetermined condition is satisfied even though the communication service relating to the connection permission request from the wireless communication device to the base station corresponding to the orthogonal frequency division multiple access scheme is a specific communication service. The predetermined condition is, for example, a case in which the wireless resources of the base station corresponding to the orthogonal frequency division multiple access scheme are not sufficient. In addition, since the processing procedure is a modified example of FIGS. **28** and **29**, the same reference numerals are given to portions common to those in FIGS. **28** and **29**, and description thereof will be omitted.

In other words, when the number of connections to the base station corresponding to the orthogonal frequency division multiple access scheme relating to the connection permission request is equal to or greater than the threshold value (Step **S1100**), the process advances to Step **S1101**.

FIG. **31** is a flowchart showing still another example of the processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. This example also shows a case in which the wireless communication device is connected to the base station corresponding to code division multiplexing access scheme if the predetermined condition is satisfied even though the communication service relating to the connection permission request to the base station corresponding to the orthogonal frequency division multiple access scheme is the specific communication service, as in the example shown in FIG. **30**. In addition, since the processing procedure is another modified example of FIGS. **28** and **29**, the same reference numerals are given to portions common to those in FIGS. **28** and **29**, and description thereof will be omitted.

In other words, when the number of connections to the base station as a new candidate is equal to or greater than the threshold value (Step **S943**), the process advances to Step **S1101**.

As such, it is possible to preferentially assign the resources of the selected wireless communication network of the orthogonal frequency division multiple access scheme to the wireless communication device using the specific communication service. Furthermore, the specific communication service is, for example, the continuously provided communication service, or the communication service provided with low-delay, as described above. In addition, when the wireless resources of the base station corresponding to the orthogonal frequency division multiple access scheme are not sufficient, it is possible to allow the wireless communication device to set the connection right so as to be connected to a base station with a low congestion degree among base stations corresponding to the code division multiplexing access scheme. Furthermore, a service other than the specific communication service is, for example, the intermittently provided communication service or the communication service provided without low-delay.

Furthermore, it may be possible to set the preference of performing a processing procedure among those shown in FIGS. **12** to **15** and FIGS. **28** to **31** with a user operation. Such a setting operation can be performed, for example, with the operation reception unit **340** of the wireless communication device **300**.

[Selection Example of Connection Point in Consideration of Communication Cost]

Hereinabove, an example of selecting the optimum communication carrier for the communication service that the user wants based on the congestion degree, or the like, is shown. Herein, it is also considered that importance is put more on communication cost than on a communication rate depending on users. Therefore, hereinafter, an example of selecting the optimum communication carrier for a communication service according to the preference of a user will be shown.

[Display Example in Initial Setting]

FIGS. **16**A and **16**B are diagrams showing display screen examples displayed in the wireless communication device **300** according to the first embodiment of the present disclosure.

FIG. **16**A shows a setting screen example (setting screen **500**) for setting conditions when a desired base station (communication carrier) is to be selected when the communication service that the user wants is to be received using the wireless communication device **300**. The setting screen **500** displays radio buttons **501**, a detailed setting button **502**, and an OK button **503**.

For example, the user can set conditions for when the desired base station (communication carrier) is to be selected by selecting a desired radio button **501** and then pressing down the OK button **503**.

For example, when "select high-speed service at all times" is selected, a connection permission request for being connected to a communication carrier that is expected to provide at a high speed is performed based on the congestion degree information. In addition, for example, when "select low-cost service at all times" is selected, a connection permission request for being connected to a communication carrier that provides a service at the lowest cost is performed based on communication cost information.

In addition, when detailed setting thereof is to be performed, a detailed setting screen (not shown in the drawing) is displayed after pressing down the detailed setting button **502** to perform detailed setting on the detailed setting screen.

FIG. **16**B shows the other setting screen example (setting screen **510**). The setting screen **510** displays radio buttons **511**, an input box for connection point in high-speed service **512**, application buttons **513** and **515**, an input box for connection point in low-cost service **514**, and an OK button **516**.

For example, the user can set conditions for when the desired base station (communication carrier) is to be selected by selecting a desired radio button **511** and pressing down the OK button **516**.

For example, in a case where "standard setting" is selected, when the "continuously provided communication service" is to be received, a connection permission request for being connected to the communication carrier corresponding to the high-speed communication service is made. On the other hand, when the "intermittently provided communication service" is to be received, a connection permission request for being connected to the communication carrier corresponding to the low-cost communication service is made.

In addition, for example, when "user setting" is selected, each connection point (such as URL) for being connected to the communication carrier corresponding to the high-speed communication service or the low-cost communication service is set by a user operation. In other words, it is possible to set each connection point (such as URL) by inputting each connection point (such as URL) in the input box for connection point in high-speed service **512** or the input box for connection point in low-cost service **514** and pressing down the application buttons **513** and **515**. Furthermore, as the detailed setting method in FIG. **16**A, the setting method shown in FIG. **16**B can also be used.

As such, by setting whether to select an appropriate wireless communication network based on the congestion degree or based on the communication cost, it is possible to automatically select as the user wanted according to the setting when the connection permission request is transmitted.

In addition, in the example to be shown below, the threshold value retaining unit **261** retains two threshold values (a first threshold value and a second threshold value), and a threshold value determination process is performed using either of the values. Herein, fixed values may be used as the first and second threshold values, and the values may be periodically or non-periodically changed based on the congestion degree or the predicted communication rate retained in the information processing device **200**.

In addition, in regard to the first threshold value and the second threshold value, it is possible to set an equal value in order to fairly deal with a wireless communication device that selects a base station (communication carrier) based on the congestion degree and a wireless communication device that selects a base station (communication carrier) based on a communication cost. In addition, since it is presumed that the wireless communication device that selects a base station (communication carrier) based on a communication cost activates a communication service that does not relatively necessitate a communication rate, the second threshold value can be set to a higher value than the first threshold value. In other words, the second threshold value can be set to a value in which conditions are further alleviated than in the first threshold value. Herein, in parallel to setting the second threshold value to be higher than the first threshold value, it may be possible to put a communication speed limitation for the communication service for the wireless communication device that select a base station based on a communication cost. In addition, the first and the second threshold values may be dynamically changed according to the congestion degrees, and the magnitude relationship between the first and the second threshold values may be dynamically changed.

[Operation Example of Wireless Communication Device]

Next, an operation of the wireless communication device **300** according to the first embodiment of the present disclosure will be described with reference to drawings.

FIG. **17** is a flowchart showing an example of a processing procedure of a communication service control process by the wireless communication device **300** according to the first embodiment of the present disclosure. Since the processing procedure is of a modified example of FIG. **11**, the same reference numerals are given to the portions common to those in FIG. **11**, and description thereof is omitted.

When the communication service start operation has been performed (Step S**902**), the control unit **330** determines whether or not the communication service relating to the communication service start operation by the user is a high-speed communication service (Step S**951**). Then, when the service is determined to be a high-speed communication service (Step S**951**), the process advances to Step S**903**. On the other hand, when the communication service relating to the communication service start operation by the user is determined not to be a high-speed communication service (Step S**951**), communication cost information is obtained (Step S**952**). In other words, the control unit **330** acquires from the communication cost information storage unit **390** the communication cost information relating to the plurality of base stations connectable at the position where the wireless communication device **300** is present (Step S**952**). Subsequently, the control unit **330** selects the base station (communication carrier) with the lowest communication cost from the plurality of base stations relating to the acquired communication cost information (Step S**953**). Furthermore, when the selected base station is the base station operated by the first communication carrier having a contract with the user of the wireless communication device **300**, the connection process is performed based on the USIM information retained in the wireless communication device **300** without performing processes thereafter.

Subsequently, the control unit **330** transmit a connection permission request for using the selected base station (communication carrier) to the information processing device **200** through the first network control device **120** (Step S**954**).

As such, the wireless communication device **300** can select a base station with a low congestion degree based on the congestion degree information relating to the plurality of base stations connectable at the position. In addition, the wireless communication device **300** can select a wireless communication network with a low communication cost based on the communication cost information relating to the plurality of base stations connectable at the position. In other words, it is possible to provide the desired service with a high probability to a wireless communication device that wants a connection expecting a high communication rate or a low communication cost, and thus, it is possible to provide a wireless communication service catering to the type of the communication service or the preference of the user.

[Operation Example of Information Processing Device]

Next, an operation of the information processing device **200** according to the first embodiment of the present disclosure will be described with reference to drawings.

[Operation Example when the Intent of not Permitting Connection is to be Displayed]

FIG. **18** is a flowchart showing an example of a processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. The example shows that, when the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request is equal to or higher than the threshold value (the first or the second threshold value), the intent of not permitting the connection to the base station relating to the connection permission request is displayed in the wireless communication device. In addition, since the processing procedure is of a modified example of FIG. **12**, the same reference numerals are given to the portions common to those in FIG. **12**, and description thereof is omitted.

When the connection permission request has been received (Step S**915**), the connection permission determination unit **260** determines whether or not the connection permission request is based on the congestion degree, based on selection criterion information included in the connection permission request (Step S**955**). When the connection permission request is based on the congestion degree (Step S**955**), the connection permission determination unit **260** performs a connection permission determination process using the first threshold value (Step S**956**). In other words, the connection permission determination unit **260** acquires from the connection number calculation unit **250** the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request, and compares the acquired number of connections and the first threshold value (Step S**956**).

When the number of connections is less than the first threshold value (Step S**956**), the process advances to Step S**917**, and when the number of connections is equal to or higher than the first threshold value (Step S**956**), the process advances to Step S**920**.

When the connection permission request is not based on the congestion degree (Step S**955**), connection permission determination unit **260** performs the connection permission determination process using the second threshold value (Step S**957**). In other words, the connection permission determination unit **260** acquires from the connection number calculation unit **250** the number of wireless communication devices (the number of connections) connected to the base station relating to the connection permission request, and compares the acquired number of connections and the second threshold value (Step S**957**).

When the number of connections is less than the second threshold value (Step S**957**), USIM information rewriting control unit **270** transmits connection permission indicating the intent of permitting the connection to the base station relating to the connection permission request to the wireless communication device that transmitted the connection permission request (Step S**958**). In this case, the connection permission is transmitted through the network control device relating to the USIM information retained in the wireless communication device that transmitted the connection permission request. On the other hand, when the number of connections is equal to or higher than the second threshold value (Step S**957**), the process advances to Step S**920**.

In addition, in the same manner as in the example shown in FIG. **13**, when the number of connections to the base station is less than the second threshold value (Step S**957**), a base station with the next lowest communication cost to the base station is selected as a new candidate, and a second threshold value determination process may be performed for the candidate.

As such, when the number of connections permitted for the connection to the base station relating to the connection permission request reaches the first threshold value, the intent of not permitting the connection to the base station relating to the connection permission request is notified to the wireless communication device that transmitted the connection permission request based on the congestion degree of the pre-

dicted communication rate. In addition, when the number of connections permitted for the connection to the base station relating to the connection permission request reaches the second threshold value, the intent of not permitting the connection to the base station relating to the connection permission request is notified to the wireless communication device that transmitted the connection permission request based on the communication cost.

[Operation Example when Specific Communication Service is Preferentially Connected]

FIG. **19** is a flowchart showing an example of a processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure. FIGS. **19** and **20** show that, when the communication service relating to the connection permission request from the wireless communication device is a specific communication service, connection relating to the connection permission request is preferentially performed. In addition, since the processing procedures thereof is of a modified example of FIG. **18**, the same reference numerals are given to the portions common to those in FIG. **18**, and description thereof is omitted.

When the connection permission request is based on the congestion degree (Step S**955**), the communication service type determination unit **212** determines the type of the communication service relating to the connection permission request (Step S**960**). Subsequently, the connection permission determination unit **260** determines whether or not the type of the communication service relating to the connection permission request is the specific communication service (Step S**961**). When the type of the communication service relating to the connection permission request is the specific communication service (Step S**961**), the process advances to Step S**956**, and when it is not the specific communication service, the process advances to Step S**957**.

FIG. **20** is a flowchart showing the example of the processing procedure of the USIM information rewriting control process by the information processing device **200** according to the first embodiment of the present disclosure.

When the connection permission request is not based on the congestion degree (Step S**955**), the communication service type determination unit **212** determines the type of the communication service relating to the connection permission request (Step S**962**). Subsequently, the connection permission determination unit **260** determines whether or not the type of the communication service relating to the connection permission request is the specific communication service (Step S**963**). When the type of the communication service relating to the connection permission request is the specific communication service (Step S**963**), the process advances to Step S**956**, and when it is not the specific communication service, the process advances to Step S**957**.

As such, it is possible to allocate the resources of the wireless communication network selected by the wireless communication device to a wireless communication device that desires a further continuous communication service.

Furthermore, it may be possible to set the preference of performing a processing procedure among those shown in FIGS. **12** to **15**, FIGS. **17** to **20** and FIGS. **28** to **31** with a user operation. Such a setting operation can be performed, for example, with the operation reception unit **340** of the wireless communication device **300**.

[Connection Permission Example Based on Relationship Between Type of Communication Service and Congestion Degree]

Hereinabove, an example of determining whether or not to give connection permission having the number of connections to the base station as the determination reference is shown. Herein, it is also considered to give connection permission based on the relationship between the type of the communication service and the congestion degree of the base station. Therefore, hereinafter, an example of giving connection permission based on the relationship between the type of the communication service and the congestion degree of the base station will be shown.

FIGS. **21**A and **21**B are diagrams showing an example of criteria of determination used in a connection determination process by the connection permission determination unit **260** according to the first embodiment of the present disclosure.

FIG. **21**A shows the relationship between a communication service and limited protocol/port. An application level **551** indicates levels corresponding to a type of communication service **552** and a limited protocol/port **553**. For example, L1 corresponds to an intermittently provided communication service, L3 corresponds to a continuously provided communication service, and L2 corresponds to an intermediate communication service therebetween.

FIG. **21**B shows the relationship between congestion degrees and permission target communication services. For example, when a congestion degree **561** is relatively high, only the communication service of which the application level **551** is L1 is permitted (a permitted application level **562** is "L1"). In addition, when the congestion degree **561** is relatively low, for example, the communication service of which the application level **551** is any one of L1 to L3 is also permitted (the permitted application level **562** is "L1, L2, and L3").

For example, the connection permission determination unit **260** retains the tables shown in FIGS. **21**A and **21**B. Then, when the connection permission request has been received, it is determined whether or not the communication service relating to the connection permission request is to be permitted based on the relationship between the type of the communication service relating to the connection permission request and the congestion degree, and only when it is determined to permit the service, a threshold value determination process can be performed. In other words, the connection permission determination unit **260** can specify a connection permission request to be permitted among connection permission requests based on the congestion degree relating to the plurality of base stations to which the wireless communication device can be connected and the type of the communication service relating to the connection permission request.

2. Second Embodiment

In the first embodiment of the present disclosure, an example has been shown in which the optimum communication carrier for the communication service that the user wants is selected based on the congestion degree or the communication cost. Herein, it is assumed that, even if the connection permission request from the wireless communication device is based on the congestion degree, a high-speed communication service is not executed in communication corresponding to the connection permission request. In such a case, it is considered that wireless resources can be efficiently used such that other users who want the high-speed communication service are permitted for connection to the base station. Thus, a second embodiment of the present disclosure shows an example in which, in communication corresponding to the connection permission request from the wireless communication device, other users are preferentially permitted for the connection to the base station when the communication ser-

vice corresponding to the connection permission request is not being executed. Furthermore, the configuration of a communication system according to the second embodiment of the present disclosure is substantially the same as that in the first embodiment of the present disclosure. For this reason, the same reference numerals are given to portions common to those in the first embodiment of the present disclosure, and part of the description thereof is omitted.

[Configuration Example of Information Processing Device]

FIG. **22** is a block diagram showing a functional configuration example of an information processing device **600** according to the second embodiment of the present disclosure. Furthermore, the information processing device **600** is a modified example of the information processing device **200** shown in FIG. **3**. For this reason, the same reference numerals are given to portions common to those in the information processing device **200**, and part of the description thereof is omitted.

The information processing device **600** includes a wireless communication device information updating unit **610**, a wireless communication device information retaining unit **620**, a connection permission determination unit **630**, and a connection information calculation unit **631**.

The wireless communication device information updating unit **610** updates retained content of the wireless communication device information retaining unit **620** based on each piece of information (such as a connection permission request, SIR, or the like) output from the communication unit **211** and the determination result output from the communication service type determination unit **212**. The updating method will be described in detail with reference to FIG. **24**.

The wireless communication device information retaining unit **620** is a retaining unit that retains information on each wireless communication device (wireless communication device information). In addition, the wireless communication device information retaining unit **620** has the retained information (wireless communication device information) to be sequentially updated by the wireless communication device information updating unit **610**. Furthermore, the retained content of the wireless communication device information retaining unit **620** will be described in detail with reference to FIG. **23**.

The connection information calculation unit **631** calculates connection information on the number of wireless communication devices connected to the base station relating to the connection permission request transmitted therefrom based on the retained content of the wireless communication device information retaining unit **620**. In addition, the connection information calculation unit **631** outputs the calculated connection information to the connection permission determination unit **630**. The calculation method of the connection information will be described in detail with reference to FIG. **23**.

The connection permission determination unit **630** extracts, as a connection point change candidate, a wireless communication device of which the type of the communication service relating to the connection permission request and the type of the service operated between the base station after connection according to the connection permission request do not coincide. Then, the connection permission determination unit **630** determines permission or non-permission on the connection permission request based on a comparison result of the connection information calculated by the connection information calculation unit **631** and the threshold value retained in the threshold value retaining unit **261**. In this case, the connection permission determination unit **630** determines permission on the connection permission request when the connection point change candidate is extracted even though the determination based on the comparison result is non-permission on the connection permission request. The extraction process and the determination process will be described in detail with reference to FIGS. **25** to **27**.

[Example of Content of Wireless Communication Device Information Retaining Unit]

FIG. **23** is a diagram schematically showing an example of the retained content of the wireless communication device information retaining unit **620** according to the second embodiment of the present disclosure.

The wireless communication device information retaining unit **620** is a retaining unit that retains information on each wireless communication device (wireless communication device information). Specifically, the wireless communication device information retaining unit **620** retains terminal identification information **621**, a cell ID **622**, and connection-permitting communication carrier **623** each of which is linked to a wireless communication device. In addition, the wireless communication device information retaining unit **620** retains a service type **624**, a congestion degree flag **625**, a communication cost flag **626**, a weighted coefficient **627**, and a connection point change candidate **628** each of which is linked to a wireless communication device. Furthermore, since the terminal identification information **621**, the cell ID **622**, and the connection-permitting communication carrier **623** correspond to the terminal identification information **241**, the cell ID **242**, and the connection-permitting communication carrier **243** shown in FIG. **6**A, description thereof is omitted.

The service type **624** is for the type of communication service. For example, "C1" indicates the type of continuously provided communication service such as a streaming service, or the like, and "I1" indicates the type of communication service intermittently operated such as browsing, or the like. In this example, only "C1" and "I1" are shown as the service type **624**, but the type can be retained after being more finely divided. For example, the continuously provided communication service may be more finely divided (into, for example, C1, C2, C3, and C4), and the intermittently provided communication service may be more finely divided (into, for example, I1, I2, I3, and I4). In addition, as the type of a communication service, a communication service provided with low-delay may be added thereto. Furthermore, the communication service provided with low-delay is, for example, the service for executing applications such as on-line games, and the like. In addition, based on the relationship between the application level **551** and the type of communication service **552** shown in FIG. **21**A, L1 and L2 can correspond to I1, and L3 can correspond to C1. In addition, L1 may correspond to I1, and L2 and L3 may correspond to C1.

The congestion degree flag **625** is a flag indicating whether or not the connection permission request from the wireless communication device is transmitted for the selection of the communication service with a low congestion degree. If the connection permission request from the wireless communication device is transmitted for the selection of the communication service with a low congestion degree, "1" is stored. On the other hand, if the connection permission request from the wireless communication device is transmitted not for the selection of the communication service with a low congestion degree, "0" is stored.

The communication cost flag **626** is a flag indicating whether or not the connection permission request from the wireless communication device is transmitted for the selection of the communication service with a low communication cost. If the connection permission request from the wireless communication device is transmitted for the selection of the

communication service with a low communication cost, "1" is stored. On the other hand, if the connection permission request from the wireless communication device is transmitted not for the selection of the communication service with a low communication cost, "0" is stored.

The weighted coefficient **627** is a weighted coefficient assigned to the wireless communication device of which connection is permitted according to the connection permission request. For example, a weighted value based on the distance between the base station relating to the connection permission request and the wireless communication device, or a weighted value based on a signal-power-to-interference-power ratio of a pilot signal received from the base station can be set as the weighted coefficient. Using the weighted coefficient, the connection information calculation unit **631** calculates the connection information on the number of wireless communication devices connected to the base station relating to the connection permission request transmitted from the wireless communication device. For example, the connection information calculation unit **631** calculates the connection information by sequentially adding the weighted coefficients **627** assigned to the wireless communication device connected to the base station relating to the connection permission request. Then, using the connection information calculated by the connection information calculation unit **631**, the connection permission determination unit **630** performs threshold value determination. For example, when the wireless communication device moves, the SIR of a pilot channel being received deteriorates according to the distance apart from the connected base station. For this reason, even wireless communication devices connected to the same base station have changing weighted coefficients according to the distance to the base station. For example, such a weighted coefficient is periodically or non-periodically updated.

For example, in a system of HSDPA and thereafter, a base station dynamically changes a modulation scheme and a coding rate based on a CQI (Channel Quality Indicator) sent from a wireless communication device to the base station. For example, assume a case where a base station provides a service at the same communication rate to a wireless communication device present at a relatively close position and a wireless communication device present at a relatively distant position. In this case, more resources have to be allocated to the wireless communication device present at a relatively distant position. On the contrary, a few resources are enough to be provided to the wireless communication device present at a relatively close position to the base station. For this reason, it is possible to give connection permission to a lot of wireless communication devices by giving priority to the wireless communication device present at a relatively close position to the base station. In other words, the load on the base station changes according to the distance to the base station or the pilot signal reception quality. Thus, it is possible to perform further appropriate threshold determination by weighting the number of wireless communication devices connected to the base station using each piece of the information.

In addition, the connection permission determination unit **630** can set, for example, a priority degree to the wireless communication device that transmits the connection permission request using each piece of the information. In other words, the connection permission determination unit **630** sets the priority degree based on the distance between the base station relating to the connection permission request and each wireless communication device connected thereto, or a signal-power-to-interference-power ratio of a pilot signal received from the base station. In this case, it is possible to perform the threshold value determination for the wireless communication device according to the priority degree. For example, it is possible that the priority degrees are set to wireless communication devices that make a connection request within a certain period and threshold determination is performed for the wireless communication devices in descending order of the priority degrees.

The connection point change candidate **628** is information indicating a wireless communication device extracted as a connection point change candidate by the connection permission determination unit **630**. "1" is stored for the wireless communication device extracted as a connection point change candidate. On the other hand, "0" is stored for the wireless communication device extracted not as a connection point change candidate.

[Operation Example of Information Processing Device]

Next, an operation of the information processing device **600** according to the second embodiment of the present disclosure will be described with reference to drawings.

[Operation Example when Wireless Communication Device Information is Updated]

FIG. **24** is a flowchart showing an example of a processing procedure of a wireless communication device information updating control process by the information processing device **600** according to the second embodiment of the present disclosure.

First, the wireless communication device information updating unit **610** determines whether or not new connection permission has been transmitted to the wireless communication device based on the information from the communication unit **211** (Step S**971**). When the new connection permission has not been transmitted to the wireless communication device, the process advances to Step S**976**. On the other hand, when the new connection permission has been transmitted to the wireless communication device (Step S**971**), the wireless communication device information updating unit **610** determines whether or not the wireless communication device to which the new connection permission was transmitted has selected a communication service with a low congestion degree (Step S**972**). When the wireless communication device to which the new connection permission was transmitted has selected the communication service with the low congestion degree (Step S**972**), the wireless communication device information updating unit **610** sets the congestion degree flag for the wireless communication device (Step S**973**). In other words, "1" is recorded for the wireless communication device in the congestion degree flag **625** of the wireless communication device information retaining unit **620**.

When the wireless communication device has not selected the communication service with the low congestion degree (Step S**972**), the wireless communication device information updating unit **610** determines whether or not the wireless communication device has selected a communication service with a low communication cost (Step S**974**). When the wireless communication device has selected the communication service with a low communication cost (Step S**974**), the wireless communication device information updating unit **610** sets a communication cost flag for the wireless communication device (Step S**975**). In other words, "1" is recorded for the wireless communication device in the communication cost flag **626** of the wireless communication device information retaining unit **620**.

When the wireless communication device has not selected the communication service with a low communication cost (Step S**974**), the communication service type determination unit **212** determines the type of the communication service

relating to each wireless communication device to which the connection permission is transmitted (Step S976). Subsequently, the wireless communication device information updating unit **610** updates the retained content of the wireless communication device information retaining unit **620** for the wireless communication device of which the type of the communication service has been changed (Step S977) based on the determination result. In other words, the content of the service type **624** of the wireless communication device information retaining unit **620** on the wireless communication device of which the type of the communication service has been changed is updated.

Subsequently, the wireless communication device information updating unit **610** detects an SIR relating to each wireless communication device to which the connection permission is transmitted (Step S978). Then, the wireless communication device information updating unit **610** calculates the weighted coefficient of each wireless communication device to which the connection permission is transmitted based on the detection result (Step S979). Next, the wireless communication device information updating unit **610** updates the retained content of the wireless communication device information retaining unit **620** based on the calculated weighted coefficient of each wireless communication device (Step S980). In other words, the content of the weighted coefficient **627** of the wireless communication device information retaining unit **620** on each wireless communication device to which the connection permission is transmitted is updated.

This example shows that the SIR relating to each wireless communication device to which the connection permission is transmitted is detected and the weighted coefficient is calculated based on the detection result, but another calculation method may be used. For example, it may be possible that path-loss relating to each wireless communication device to which the connection permission is transmitted is detected, and a weighted coefficient is calculated based on the detection result. In addition, it may be possible that, for example, the distance to the base station is calculated from position information relating to each wireless communication device to which the connection permission is transmitted and a weighted coefficient is calculated based on the distance.

[Operation Example when Connection Point Change Candidate is to be Registered]

FIG. **25** is a flowchart showing an example of a processing procedure of a connection point change candidate registration control process by the information processing device **600** according to the second embodiment of the present disclosure. This example shows that a connection point change candidate is extracted and registered based on the congestion degree flag and the service type.

First, the connection permission determination unit **630** determines whether or not there is a base station to which the number of connections of wireless communication devices is equal to or higher than a threshold value based on the retained content of the wireless communication device information retaining unit **620** (Step S981), and when there is no base station to which the number of connections is equal to or higher than the threshold value, monitoring is continued. When there is a base station to which the number of connections is equal to or higher than the threshold value (Step S981), the connection permission determination unit **630** extracts a wireless communication device for which the congestion degree flag is set out of the wireless communication devices connected to the base station to which the number of connections is equal to or higher than the threshold value (Step S982). In other words, a wireless communication device is extracted for which "1" is recorded in the congestion degree flag **625** of the wireless communication device information retaining unit **620** out of the wireless communication devices connected to the base station to which the number of connections is equal to or higher than the threshold value. Herein, as the threshold value used in Step S981, for example, the same value as the first threshold value shown in FIG. **18**, or the like can be used. In addition, a value less than the first threshold value (for example, a value obtained by multiplying 0.75) may be used. In addition, this example shows that a wireless communication device is extracted based on the comparison result between the number of connections of the wireless communication devices and the threshold value, but a wireless communication device may be extracted based on a comparison result between a value obtained by considering a weight assigned to each wireless communication device and the threshold value. The value obtained by considering a weight, for example, is a value obtained by adding the weighted coefficients **627** shown in FIG. **23** in a unit of base station.

Subsequently, the connection permission determination unit **630** determines whether or not the wireless communication device for which the congestion degree flag is set is extracted (Step S983), and when the wireless communication device for which the congestion degree flag is set is not extracted, the operation of the connection point change candidate registration control process ends. On the other hand, when the wireless communication device for which the congestion degree flag is set is extracted (Step S983), the connection permission determination unit **630** extracts a wireless communication device for which I1 is set in the service type out of extracted wireless communication devices (Step S984). In other words, a wireless communication device for which "I1" is recorded in the service type **624** of the wireless communication device information retaining unit **620** is extracted.

Subsequently, the connection permission determination unit **630** determines whether or not the wireless communication device for which I1 is set in the service type is extracted (Step S985). Then, when the wireless communication device for which I1 is set in the service type is not extracted, the operation of the connection point change candidate registration control process ends. On the other hand, when the wireless communication device for which I1 is set in the service type is extracted (Step S985), the connection permission determination unit **630** registers the wireless communication device for which I1 is set in the service type as a connection point change candidate (Step S986). In other words, "1" is recorded in the connection point change candidate **628** of the wireless communication device information retaining unit **620**.

FIG. **26** is a flowchart showing an example of a processing procedure of a connection point change candidate registration control process by the information processing device **600** according to the second embodiment of the present disclosure. This example shows that a connection point change candidate is extracted and registered based on a communication cost flag and a service type.

First, the connection permission determination unit **630** determines whether or not there is a base station to which the number of connections of wireless communication devices is equal to or higher than a threshold value based on the retained content of the wireless communication device information retaining unit **620** (Step S991), and when there is no base station to which the number of connections is equal to or higher than the threshold value, monitoring is continued. When there is a base station to which the number of connec-

tions is equal to or higher than the threshold value (Step S**991**), the connection permission determination unit **630** extracts a wireless communication device for which a communication cost flag is set out of the wireless communication devices connected to the base station to which the number of connections is equal to or higher than the threshold value (Step S**992**). In other words, a wireless communication device is extracted for which "1" is recorded in the communication cost flag **626** of the wireless communication device information retaining unit **620** out of the wireless communication devices connected to the base station to which the number of connections is equal to or higher than the threshold value. Herein, as the threshold value used in Step S**991**, for example, the same value as the second threshold value shown in FIG. **18**, or the like can be used. In addition, a value less than the second threshold value (for example, a value obtained by multiplying 0.75) may be used. In addition, this example shows that a wireless communication device is extracted based on the comparison result between the number of connections of the wireless communication devices and the threshold value, but a wireless communication device may be extracted based on a comparison result between a value obtained by considering a weight assigned to each wireless communication device and the threshold value. The value obtained by considering a weight, for example, is a value obtained by adding the weighted coefficients **627** shown in FIG. **23** in a unit of base station.

Subsequently, the connection permission determination unit **630** determines whether or not the wireless communication device for which the communication cost flag is set is extracted (Step S**993**), and when the wireless communication device for which the communication cost flag is set is not extracted, the operation of the connection point change candidate registration control process ends. On the other hand, when the wireless communication device for which the communication cost flag is set is extracted (Step S**993**), the connection permission determination unit **630** extracts a wireless communication device for which C1 is set in the service type out of extracted wireless communication devices (Step S**994**). In other words, a wireless communication device for which "C1" is recorded in the service type **624** of the wireless communication device information retaining unit **620** is extracted.

Subsequently, the connection permission determination unit **630** determines whether or not the wireless communication device for which C1 is set in the service type is extracted (Step S**995**). Then, when the wireless communication device for which C1 is set in the service type is not extracted, the operation of the connection point change candidate registration control process ends. On the other hand, when the wireless communication device for which C1 is set in the service type is extracted (Step S**995**), the connection permission determination unit **630** registers the wireless communication device for which C1 is set in the service type as a connection point change candidate (Step S**996**). In other words, "1" is recorded in the connection point change candidate **628** of the wireless communication device information retaining unit **620**. Furthermore, Steps S**981** to S**986** and S**991** to S**996** are an example of the extraction procedure described in the claims.

As such, the connection permission determination unit **630** extracts, as a connection point change candidate, a wireless communication device of which the type of the communication service relating to the connection permission request and the type of the service operated between the base station after connection according to the connection permission request do not coincide.

[Operation Example where Connection Point Change Candidate is Used]

FIG. **27** is a flowchart showing an example of a processing procedure of a USIM information rewriting control process by the information processing device **600** according to the second embodiment of the present disclosure. This example shows that, when a new connection permission request is transmitted, a wireless communication device that transmitted the connection permission request is connected taking priority over the connection point change candidate. In addition, since the processing procedure is of a modified example of FIG. **12**, the same reference numerals are given to the portions common to those in FIG. **12**, and description thereof is omitted.

When the connection permission request is received (Step S**915**), the connection permission determination unit **630** performs a connection permission determination process (Step S**1000**). In other words, the connection permission determination unit **630** acquires, from the connection information calculation unit **631**, information on the number of wireless communication devices connected to the base station relating to the connection permission request (connection information), and compares the acquired connection information and a threshold value (Step S**1000**). Then, when the connection information is equal to or higher than the threshold value (Step S**1000**), the connection permission determination unit **630** determines whether or not there is a connection point change candidate for the base station (Step S**1001**). In other words, it is determined whether or not "1" is recorded in the connection point change candidate **628** of the wireless communication device information retaining unit **620** in relation to the base station.

When there is no connection point change candidate for the base station (Step S**1001**), the process advances to Step S**920**. On the other hand, when there is a connection point change candidate for the base station (Step S**1001**), the USIM information rewriting control unit **270** transmits connection permission to the wireless communication device that transmitted the connection permission request (Step S**1002**). Furthermore, the connection permission indicates the intent of permitting connection to the base station relating to the connection permission request.

Subsequently, the USIM information rewriting control unit **270** transmits connection permission (re-connection instruction) indicating the intent of permitting connection to a base station with the next low congestion degree to the base station to a wireless communication device as the connection point change candidate (Step S**1003**). In this case, in Steps S**918** and S**919**, a USIM information restoration process is performed for each wireless communication device to which the connection permission is transmitted in Steps S**1002** and S**1003**. For example, when the connection of either of the wireless communication devices is completed, the USIM information restoration process is performed for the wireless communication device, and for the other wireless communication device, a restoration process of the USIM information at the time of transmitting the re-connection instruction may be performed.

FIG. **32** is a flowchart showing another example of the processing procedure of the USIM information rewriting control process by the information processing device **600** according to the second embodiment of the present disclosure. The example shows a case in which, when a new connection permission request is transmitted to a base station corresponding to the orthogonal frequency division multiple access scheme, the wireless communication device that transmitted the connection permission request is preferentially

connected to the base station to a connection point change candidate. In addition, the processing procedure is a modified example of FIG. **27**, the same reference numerals are given to portions common to those in FIG. **27**, and description thereof will be omitted.

When the connection permission request is received (Step S**915**), the connection permission determination unit **630** determines whether or not the number of connections to the base station corresponding to the orthogonal frequency division multiple access scheme relating to the connection permission request is less than the threshold value (Step S**1200**). Then, when the number of connections is less than the threshold value (Step S**1200**), the process advances to Step S**917**. In addition, when the number of connections is equal to or greater than the threshold value (Step S**1200**), the connection permission determination unit **630** determines whether or not there is a connection point change candidate for the base station corresponding to the orthogonal frequency division multiple access scheme relating to the connection permission request (Step S**1001**). Then, when there is a connection point change candidate (Step S**1001**), the USIM information rewriting control unit **270** transmits connection permission indicating the intent of permitting connection to the base station relating to the connection permission request to the wireless communication device that was transmitted to the connection permission request (Step S**1002**).

Subsequently, the USIM information rewriting control unit **270** transmits connection permission (re-connection instruction) indicating the intent of permitting connection to a base station with the lower congestion degree among base stations corresponding to the code division multiplexing access scheme to the wireless communication device as the connection point change candidate (Step S**1201**). In this case, in Steps S**918** and S**919**, a USIM information restoration process is performed for each wireless communication device to which the connection permission is transmitted in Steps S**1002** and S**1201**. For example, when connection of any one of the wireless communication devices is completed, the USIM information restoration process may be performed for the wireless communication device, and a process of restoring USIM information during transmission of the re-connection instruction may be performed for other wireless communication devices.

Furthermore, it may be possible to set with a user operation which procedure among the processing procedures shown in FIGS. **12** to **15**, FIGS. **17** to **20**, and FIGS. **27** to **32** is to be performed. For example, such a setting operation can be performed with the operation reception unit **340** of the wireless communication device **300**.

As such, it is possible to select a wireless communication network based on the congestion degree, and to provide a communication service preferentially to a wireless communication device desiring a continuously provided communication service. In other words, the wireless communication network is selected based on the congestion degree and a wireless communication device operating a communication service not using a high communication rate is made to use another wireless communication network. In addition, a wireless communication device that has desired connection later expecting a high communication rate is provided with the desired communication service. In other words, it is possible to continuously provide the service at the desired communication rate to the wireless communication device using a specific communication service. In addition, after reaching the maximum number of connections that can maintain the desired communication rate, it is possible to provide a service at a relatively high communication rate for the wireless communication device using the specific communication service. Accordingly, it is possible to select a wireless communication network based on the congestion degree, to provide a service preferentially to a wireless communication device that desires a continuously provided communication service, and to reflect the principle of the market based on supply and demand.

Furthermore, the example shows that a base station is selected based on the congestion degree, but can be applied to a case where a base station is selected based on a predicted communication rate or a communication rate. For example, it is possible to select a base station based on the communication cost, and to provide a communication service preferentially to a wireless communication device that desires an intermittently provided communication service. In other words, for wireless communication devices being connected, a base station is selected based on the communication cost, and wireless communication devices executing a communication service using a high communication rate are instructed to be re-connected to a wireless communication network selected from the tradeoff between the communication cost and the congestion degree. Accordingly, it is possible to select the wireless communication network based on the communication cost, to provide the communication service preferentially to the wireless communication device that desires the intermittently provided communication service, and to reflect the principle of the market based on supply and demand on the communication cost.

Herein, in domestic mobile telephone services at present, users conclude their contracts with each communication carrier, and basically are permitted to use the mobile telephone networks of the contracted communication carrier. On the other hand, in foreign countries, for example, respective contracts are concluded with a plurality of communication carriers as pre-paid SIMs, or the like, a plurality of pieces of USIM information are inserted in one wireless communication device, and users switch USIM information depending on regions. In the future, it is expected to dynamically select and use a plurality of connectable wireless communication networks in the same region, regardless of communication carriers, and the type of communication schemes.

Herein, as criteria for selecting a wireless communication network, two criteria are broadly considered, which are the communication rate and the communication cost. For example, when a plurality of wireless communication devices simultaneously try to be connected to a base station that is not congested, expecting a communication service at a high communication rate, there is concern that traffic is concentrated thereto to the contrary, and thus, it is difficult to use the service at a high communication rate as originally expected. In addition, when a plurality of wireless communication devices simultaneously try to be connected to a base station that is not congested, expecting a low communication cost, there is also concern that traffic is concentrated thereto to the contrary resulting in raising the communication cost, and thus it is difficult to enjoy a low-cost communication service as originally expected. On this point, it is important to provide the communication service that users want without a hitch.

For example, it is also assumed that, when a wireless communication network that users want is selected based on the congestion degree from wireless communication networks operated by a plurality of communication carriers, traffic of the users having the same preference is concentrated. In this case, it is possible to disperse concentrating traffic and to reduce a load on the base station in the embodiments of the present disclosure. When, for example, a plurality of wireless communication devices request use of the same wireless

communication network expecting a high communication rate, it is possible to limit the number of wireless communication devices that serve as connection targets so as to be able to secure a desired communication rate. Accordingly, it is possible to provide a desired service with a high probability, for example, to the wireless communication devices that desire the connection expecting a high communication rate.

Furthermore, the embodiments of the present disclosure exemplify that, when the connection permission request is transmitted, the base station (communication carrier) that serves as a connection target is selected for the wireless communication device **300**, but, such a selection process may be performed for the information processing device **200**. For example, the connection permission request transmitted from the wireless communication device **300** is set to include selection information indicating whether the connection permission request is based on the congestion degree or a communication cost. Then, when the information processing device **200** receives the connection permission request, it is possible to select a base station (communication carrier) that serves as a connection target of the wireless communication device **300** based on the selection information included in the received connection permission request.

In addition, the embodiments of the present disclosure exemplify that the connection permission request is transmitted to the information processing device based on a user operation, but the connection permission request may be transmitted to the information processing device according to a handover process. In this case, a process of selecting a new base station is performed in a wireless communication device every time handover is detected, and the connection permission request is transmitted to the information processing device according to the selection process.

In addition, the embodiments of the present disclosure describe the examples of the information processing devices **200** and **600** formed as one unit. However, the embodiments of the present disclosure can also be applied to an information processing system constituted by a plurality of devices having each unit included in the information processing devices. In addition, the embodiments of the present disclosure can be applied to a portable type wireless communication device (for example, a data communication dedicated terminal device) other than a mobile telephone device or a fixed type wireless communication device (for example, a wireless communication device for collecting data of vending machines).

[Control Example of Transmission Frequency of Positional Information]

In recent years, there has been a growing number of cases in which predetermined information such as life-log (for example, record of a person's activities) for using applications, concierge services, or the like is uploaded to each server from wireless communication devices. In addition, it is anticipated that, if such applications, concierge services, or the like are further spread in years to come, the frequency of uploading such predetermined information from wireless communication devices to each server will further increase.

For example, in order to proper services in such applications, concierge services, or the like, it is important to transmit the predetermined information at an appropriate frequency (for example, with a fixed interval). However, since portable wireless communication devices perform each operation mostly using batteries, it is important to lower power consumption by efficiently using the batteries.

The present disclosure is created taking the above circumstance into consideration, and it is desirable for the present disclosure to lower power consumption.

In addition, the present disclosure can take the following configurations (Configuration Examples 1 to 13) for the purpose of solving the above problem.

Configuration Example 1

A wireless communication device including a control unit that controls, based on the distance between a base station and the wireless communication device performing wireless communication with an information processing device via the base station, the transmission frequency of predetermined information acquired by the wireless communication device to the information processing device.

Configuration Example 2

The wireless communication device described in Configuration Example 1, in which the control unit performs control so as to heighten the transmission frequency as the distance between the wireless communication device and the base station is shortened, and to lower the transmission frequency as the distance between the wireless communication device and the base station is lengthened.

Configuration Example 3

The wireless communication device described in Configuration Example 1 or 2, further including a positional information acquisition unit that acquires positional information for specifying the position where the wireless communication device is present, in which the control unit transmits the positional information acquired by the positional information acquisition unit to the information processing device so as to be included in the predetermined information.

Configuration Example 4

The wireless communication device described in any one of Configuration Examples 1 to 3, in which the control unit computes the distance between the wireless communication device and the base station based on path-loss, a reception level of a pilot signal, an SIR of a synchronization signal, or the positional information acquired by the positional information acquisition unit.

Configuration Example 5

The wireless communication device described in any one of Configuration Examples 1 to 4, in which the control unit changes the transmission frequency based on the remaining amount of battery power that drives the wireless communication device.

Configuration Example 6

The wireless communication device described in any one of Configuration Examples 1 to 5, in which the predetermined information includes at least one piece of information among information on a position in the zone where the wireless communication device is present, time-series information on the position where the wireless communication device is present, information on the area code in the zone where the wireless communication device is present, information on a base station in the zone where the wireless communication device is present, identification information assigned to individual access points in the zone where the wireless communication device is present, time-series information on the

reception signal intensity and the reception intensity of a pilot signal or a reference signal at the position in the zone where the wireless communication device is present, information on the peripheral base stations detected by the wireless communication device, information on the congestion degree of the base stations detected by the wireless communication device, information on the battery of the wireless communication device, and character information input by a user through the input device of the wireless communication device.

Configuration Example 7

The wireless communication device described in Configuration Example 6, in which the control unit changes the content included in the predetermined information based on the remaining amount of battery power that drives the wireless communication device.

Configuration Example 8

The wireless communication device described in Configuration Example 6 or 7, in which the control unit changes the content included in the predetermined information based on the type of a communication system that the wireless communication device uses.

Configuration Example 9

The wireless communication device described in Configuration Example 8, in which the type of the communication system is the code division multiplexing access scheme or the orthogonal frequency division multiple access scheme.

Configuration Example 10

The wireless communication device described in any one of Configuration Examples 6 to 9, in which the information processing device stores the reception signal intensity, the reception intensity of the pilot signal or the reference signal, and an index relating to interference computed based on the information on the peripheral base stations included in the predetermined information transmitted from the wireless communication device, in relation to a position specified based on the predetermined information.

Configuration Example 11

The wireless communication device described in Configuration Example 10, in which, when an acquisition request of information on reception quality is received from the wireless communication device, the information processing device outputs to the wireless communication device the reception signal intensity, the reception intensity of the pilot signal or the reference signal, and the index relating to interference relating to the position in the zone where the wireless communication device is present.

Configuration Example 12

A information processing device including a storage unit that stores predetermined information that is information including positional information transmitted from a wireless communication device and includes a reception signal intensity at a position in the zone where the wireless communication device, a reception intensity of a pilot signal or a reference signal at the position in the zone where the wireless communication device, and an index relating to interference computed based on information on the peripheral base stations detected by the wireless communication device, in relation to a position specified based on the positional information, and an output unit that outputs to the wireless communication device the reception signal intensity, the reception intensity of the pilot signal or the reference signal, and the index relating to interference relating to the position in the zone where the wireless communication device is present, when an acquisition request of information on reception quality is received from the wireless communication device.

Configuration Example 13

A control method of a wireless communication device including controlling the transmission frequency of predetermined information acquired by the wireless communication device to an information processing device based on the distance between a base station and the wireless communication device that performs wireless communication with the information processing device via the base station.

Furthermore, the embodiments of the present disclosure show examples for realizing the disclosure, and as clarified in the embodiments of the present disclosure, matters in the embodiments of the present disclosure are in a corresponding relationship with disclosure specific matters in the claims. In the same manner, the disclosure specific matters in the claims are in a corresponding relationship with the matters in the embodiments of the present disclosure given the same name. However, the embodiments of the present disclosure are not limited thereto, and can be realized by implementing various modifications within the scope not departing from the gist of the present disclosure.

In addition, the processing procedures described in the embodiments of the present disclosure may be understood as methods having the series of procedures, or may be understood as a program for causing a computer to execute the series of procedures or a recording medium recording the program. As such a recording medium, for example, hard disk, a CD (Compact Disc), an MD (MiniDisc), a DVD (Digital Versatile Disc), or the like can be used. In addition, a memory card, a Blu-ray Disc (registered trademark), or the like can be used.

Furthermore, the present disclosure can take the following configurations as well.

(1) An information processing method including determining, when a connection request for connecting, via a base station relating to a first communication carrier, a first wireless communication device to a base station relating to a second communication carrier is received from the first wireless communication device, permission or non-permission for the connection request based on connection information on the number of wireless communication devices connected to the base station relating to the connection request, and setting a connection right to be connected to the base station relating to the connection request to the first wireless communication device when permission is determined in the determining.

(2) The information processing method described in (1) above, in which, in the determining, the connection information is compared to a threshold value, and permission or non-permission for the connection request is determined based on the comparison result.

(3) The information processing method described in (2) above, in which the connection request is a connection request for being connected to the base station with the lowest congestion degree among a plurality of base stations to which

the first wireless communication device can be connected, in which, in the determining, when the number of wireless communication devices connected to the base station relating to the connection request is great based on the threshold value as a standard, a base station with the next lowest congestion degree to the base station relating to the connection request among the plurality of base stations to which the first wireless communication device can be connected is set to a target base station, and when the number of wireless communication devices connected to the target base station is less based on the threshold value as a standard, permission for connection to the target base station is determined, and when the number is great based on the threshold value as a standard, the determination is performed for the target base station by setting a base station with the further next lowest congestion degree to the target base station among the plurality of base stations to which the first wireless communication device can be connected as a new target base station, and in which, in the setting, a connection right to be connected to the target base station for which permission is determined in the determining is set to the first wireless communication device.

(4) The information processing method described in (2) above, in which, in the determining, when the number of wireless communication devices connected to the base station relating to the connection request is less based on the threshold value as a standard, permission for the connection request is determined, and when the number is great based on the threshold value as a standard, non-permission for the connection request is determined.

(5) The information processing method described in (4) above, further including displaying, when non-permission for the connection request is determined in the determining, the intent of non-permission in the first wireless communication device.

(6) The information processing method described in any one of (1) to (5) above, in which, when a communication service relating to the connection request is not a specific communication service, the determination is performed after a fixed time passes after the reception of the connection request in the determining, and in which, when permission for the connection request is determined after the fixed time passes, the connection right is set to the first wireless communication device in the setting.

(7) The information processing method described in (1) or (2) above, in which, in the determining, when the communication service relating to the connection request is not a specific communication service, a base station with the next lowest congestion degree to the base station relating to the connection request among a plurality of base stations to which the first wireless communication device can be connected is set as a target base station, when the number of wireless communication devices connected to the target base station is less based on a threshold value as a standard, permission for connection to the target base station is determined, and when the number is great based on the threshold value as a standard, non-permission for connection to the target base station is determined, and in which, in the setting, the connection right to be connected to the target base station for which permission is determined in the determining is set for the first wireless communication device.

(8) The information processing method described in any one of (2) to (5) above, in which, the connection request is a first connection request for being connected to a base station that is selected based on the congestion degrees relating to a plurality of base stations to which the first wireless communication device can be connected, or a second connection request for being connected to a base station that is selected based on a communication cost relating to the plurality of base stations to which the first wireless communication device can be connected, and in which, in the determining, the determination is performed using threshold values that are different depending on whether the connection request is the first connection request or the second connection request.

(9) The information processing method described in (8) above, in which, in the determining, when the connection request is the first connection request, the determination is performed using a first threshold value as the threshold value, and when the connection request is the second connection request, the determination is performed using a second threshold value as the threshold value, in which conditions are further alleviated than in the first threshold value.

(10) The information processing method described in (9) above, in which, in the determining, when the type of the communication service relating to the connection request is a specific communication service regardless of whether the connection request is the first connection request or the second connection request, the determination is performed using the first threshold value.

(11) The information processing method described in any one of (1) to (10) above, in which, in the determining, a connection request to be permitted is specified among the connection requests based on the congestion degree relating to a plurality of base stations to which the first wireless communication device can be connected and the type of a communication service relating to the connection request.

(12) The information processing method described in any one of (1) to (11) above, in which the congestion degree of each base station is transmitted to an information processing device that executes the determination after each wireless communication device detects the congestion degree, and in which frequency of transmitting congestion degrees detected by the wireless communication device to the information processing device is increased as the distance between the wireless communication device and the base station is shortened, and frequency of transmitting congestion degrees detected by the wireless communication device to the information processing device is reduced as the distance between the wireless communication device and the base station is lengthened.

(13) The information processing method described in any one of (2) to (5) above, further including extracting a wireless communication device of which the type of a communication service relating to the connection request does not coincide with the type of a communication service communicated between the base station relating to the connection request after connection based on the set connection right, in which, in the determining, when a wireless communication device, of which the types of the communication services do not coincide with each other, is extracted even if non-permission for the connection request is determined based on the comparison result, permission for the connection request is determined, and in which, in the setting, a connection right to be connected to a base station with the next lowest congestion degree to another base station relating to the connection right set in the extracted wireless communication device is set in the wireless communication device.

(14) The information processing method described in any one of (1) to (13) above, in which, in the determining, the determination is performed using a value, as the connection information, obtained by weighting the number of wireless communication devices connected to the base station relating to the connection request based on the distance between the base station and each of the wireless communication devices, or a value obtained by weighting the number of wireless

communication devices based on a signal-power-to-interference-power ratio of a pilot signal received from the base station.

(15) The information processing method described in any one of (1) to (14) above, in which the base station relating to the connection request is selected based on the congestion degrees or a predicted communication rate of a plurality of base stations.

(16) The information processing method described in any one of (1) to (15) above, further including determining a service type by determining whether a service is a continuously provided communication service or an intermittently provided communication service based on at least one of a connection point, a protocol, and a port number included in the connection request.

(17) The information processing method described in (1) or (2) above, in which, in the determining, when the communication service relating to the connection request is a specific communication service, a base station corresponding to the orthogonal frequency division multiple access scheme among a plurality of base stations to which the first wireless communication device can be connected is set as a target base station, when the communication service relating to the connection request is not a specific communication service, a base station corresponding to the code division multiplexing access scheme among the plurality of base stations to which the first wireless communication device can be connected is set as a target base station, and when the number of wireless communication devices connected to the target base station is small based on a threshold value, permission for connection to the target base station is determined, and when the number is great based on the threshold value, non-permission for connection to the target base station is determined, and in which, in the setting, the connection right to be connected to the target base station to which connection is determined to be permitted in the determining is set in the first wireless communication device.

(18) The information processing method described in (1) or (2) above, in which, in the determining, when the communication service relating to the connection request is a specific communication service, a base station corresponding to the orthogonal frequency division multiple access scheme among the plurality of base stations to which the first wireless communication device can be connected is set as a target base station, when the number of wireless communication devices connected to the target base station is small based on a threshold value, permission for connection to the target base station is determined, and when the number is great based on the threshold value, a base station corresponding to the code division multiplexing access scheme among the plurality of base stations to which the first wireless communication device can be connected is set as a new target base station, when the number of wireless communication devices connected to the target base station is small based on a threshold value, permission for connection to the base station is determined, and when the number is great based on the threshold value, non-permission for connection to the target base station is determined, and in which, in the setting, the connection right to be connected to the target base station to which connection is determined to be permitted in the determining is set in the first wireless communication device.

(19) The information processing method described in any one of (2) to (5) above, further including extracting a wireless communication device of which the type of a communication service relating to the connection request does not coincide with the type of a communication service communicated between the base station relating to the connection request after connection based on the set connection right, in which, in the determining, when a wireless communication device, of which the types of the communication services do not coincide with each other, is extracted even if non-permission for the connection request is determined based on the comparison result, permission for the connection request is determined, and in which, in the setting, the extracted wireless communication device is set with the connection right to be connected to a base station corresponding to the code division multiplexing access scheme from a base station corresponding to the orthogonal frequency division multiple access scheme relating to a connection right set in the wireless communication device.

(20) An information processing device including a determination unit that determines, when a connection request for connecting, via a base station relating to a first communication carrier, a first wireless communication device to a base station relating to a second communication carrier is received from the first wireless communication device, permission or non-permission for the connection request based on connection information on the number of wireless communication devices connected to a base station relating to the connection request, and a control unit that controls to set a connection right to be connected to the base station relating to the connection request to the first wireless communication device when permission is determined by the determination unit.

The present disclosure contains subject matter related to that disclosed in Japanese Priority Patent Application JP 2011-028564 filed in the Japan Patent Office on Feb. 14, 2011, the entire contents of which are hereby incorporated by reference.

It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

What is claimed is:

1. An information processing method comprising:

determining, in case a connection request for connecting, via a base station relating to a first communication operator, a first wireless communication device to a base station relating to a second communication operator is received from the first wireless communication device,

wherein the connection request comprises identification information of the base station relating to the second communication operator;

determining permission or non-permission for the connection request based on connection information on a number of wireless communication devices connected to the base station relating to the second communication operator,

wherein the connection request is a connection request for being connected to the base station with the lowest congestion degree among a plurality of base stations to which the first wireless communication device is capable of being connected, and

wherein, in the determining of the permission or non-permission, in case the number of wireless communication devices connected to the base station relating to the second communication operator is equal to or greater than a threshold value, a base station with the next lowest congestion degree to the base station relating to the second communication operator among the plurality of base stations is set to a target base station, wherein in case the number of wireless communication devices connected to the target base station is lesser than the

threshold value, permission for connection to the target base station is determined; and

setting contract authentication information related to the second communication operator to connect the target base station to the first wireless communication device based on the determined permission.

2. The information processing method according to claim **1**,

wherein, in the determining of the permission or non-permission, the connection information is compared to the threshold value, and

the permission or non-permission for the connection request is determined based on the comparison result.

3. The information processing a method of cording to claim **2**, further comprising:

extracting and identification of a wireless communication device of which a type of a communication service relating to the connection request does not coincide with another type of the communication service communication between the base station relating to the second communication operator after connection based on the set contract authentication information related to the second communication operator,

wherein, in case the identification of the wireless communication device, of which the types of the communication services do not coincide with each other, is extracted even if non-permission for the connection request is determined based on the comparison result, permission for the connection request is determined, and

wherein, in this setting, the wireless communication device corresponding to the extracted identification is set with the contract authentication information related to the second communication operator to connect to a base station corresponding to a code division multiplexing access came from a base station corresponding to an orthogonal frequency division multiple access scheme relating to a connection right set in the wireless communication device.

4. The information processing method according to claim **1**,

wherein, in the determining of the permission or non-permission, in case the number of wireless communication devices connected to the target base station is equal to or greater than the threshold value, the determination is performed for the target base station by setting a base station with the further text lowest congestion degree to the target base station among the plurality of base stations as a new target base station

wherein, in the setting, the contract authentication information related to the second communication operator to connect the largest base station, for which the permission is determined, to the first wireless communication device is set.

5. The information processing method according to claim **1**,

wherein, in the determining of the permission or non-permission, in case the number of wireless communication devices connected to the base station relating to the second communication operator is lesser than the threshold value, permission for the connection request is determined, and in case the number is equal to or greater than the threshold value, non-permission for the connection request is determined.

6. The information processing method according to claim **5**, further comprising:

displaying, in case non-permission for the connection request is determined in the determining of the permission or non-permission, and intent of non-permission in the first wireless communication device.

7. The information processing method according to claim **1**,

wherein, in case a communication service relating to the connection request is not a specific communication service, the determination is performed after effects time passes at the reception of the connection request, and

wherein, in case permission for the connection request is determined after fix time passes, the connection authentication information related to the second communication operator to connect is set to the first wireless communication device.

8. The information processing method according to claim **1**,

wherein, in the determining of the permission or non-permission, in case a communication service relating to the connection request is not a specific communication service, a base station with the lowest congestion degree to the base station relating to the second communication operator among the plurality of base stations is set as the target base station, in case the number of wireless communication devices connected to the target base station is lesser than the threshold value, permission for connection to the target base station is determined, and in case the number is equal to or greater than the threshold value, non-permission for connection to the target base station is determined, and

wherein, in the setting, the contract authentication information related to the second communication operator to connect the target base station for which permission is determined, is set for the first wireless communication device.

9. The information processing method according to claim **1**,

wherein the connection request is a first connection request for being connected to a base station that is selected based on the congestion degrees relating to the plurality of base stations, or second connection request for being connected to a base station that is selected based on the communication costs relating to the plurality of base stations, and

wherein, in the determining of the permission or non-permission, the determination is performed using threshold values that are different depending on whether the connection request is the first connection request on a second connection request.

10. The information processing method according to claim **9**,

wherein, in the determining of the permission or non-permission, in case the connection request is the first connection request, the determination is performed using a first threshold value of the threshold values as the threshold value, and in case the connection request in the second connection request, the determination is performed using a second threshold value of the threshold values as a threshold value, in which conditions are further alleviated than in the first threshold value.

11. The information processing method according to claim **10**, wherein, the determining of the permission or non-permission, in case a type of a communication service relating to the connection request is a specific communication service regardless of whether the connection request is the first connection request or the second connection request, that determination is performed using the first threshold value.

12. The information processing method according to claim **1**, wherein, in the determining of the permission or non-

permission, a connection request to be permitted is specified among connection request based on the congestion degree relating to the plurality of base stations and the type of a communication service relating to the connection request.

13. Information processing method according to claim **1**,

wherein the congestion degree of each of the plurality of base stations is transmitted to an information processing device configured to execute the determination of the commission or non-permission after each of a plurality of wireless communication devices detects the congestion degree, and

wherein frequency of transmitting congestion degrees detected by each of the plurality of wireless communication devices to the information processing device is increased as a distance between each of the plurality of wireless communication devices and the base station is shortened, and frequency of transmitting the congestion degrees detected by each of the plurality of wireless communication devices to the information processing device is reduced as the distance between each of the plurality of wireless communication devices and the base station is lengthened.

14. The information processing method according to claim **1**,

wherein, in the determining of the permission or non-permission, the determination is performed using a value, as the connection information, obtained by weighing the number of wireless communication devices connected to the base station relating to the second communication operator based on a distance between the base station and each of the wireless communication devices, or a value obtained by weighing the number of wireless communication devices based on a signal-power-to-interference-power ratio of a pilot signal received from the base station.

15. The information processing method according to claim **1**,

wherein the base station relating to the second communication operator is selected based on the congestion degrees or predicting communication rate of the plurality of the base stations.

16. Information processing method according to claim **1**, further comprising:

determining a service type by determining whether a service is a continuously provided communication service or intermittently provided communication service device on at least one of the connected point, a protocol, and a port number included in the connection request.

17. The information processing method according to claim **1**,

wherein, and the determining of the permission or non-permission, in case a communication service relating to the connection request is a specific communication service, a base station corresponding to an orthogonal frequency division multiple access scheme among the plurality of base stations is set as the target base station, in case the communication service relating to the connection request is not a specific communication service, a base station corresponding to a code division multiplexing access scheme among the plurality of base stations is set as the target base station, and in case the number of wireless communication devices connected to the target base station is lesser than the threshold value, permission for connection to the target base station is determined, and in case the number is equal to or greater than the threshold value, non-permission for connection the target base station is determined, and

wherein, in the setting, the contract authentication information related to the second communication operator to connect the target base station to which connection is determined to be permitted is set in the first wireless communication device.

18. The information processing message according to claim **1**,

wherein, in the determining of the permission or non-permission, in case a communication service relating to the connection request is a specific communication service, a base station corresponding to an orthogonal frequency division multiple access scheme among the plurality of base stations is set as the target base station, in case the number of wireless communication devices connected to the target base station is lesser than the threshold value, permission for connection to the target base station is determined, and in case the number is equal to or greater than the threshold value, a base station corresponding to the code division multiplexing access scheme among the plurality of base stations is set as a new target base station, in case the number of wireless communication devices connected to the target base station is lesser in the threshold value, permission for the connection to the base station is determined, and in case the number is equal to or greater than the threshold value, non-permission for connection to the target base station is determined, and

wherein, in the setting, the contract authentication information related to the second communication operator to connect the target base station to which connection is determined to be permitted is set in the first wireless communication device.

19. An information processing method comprising:

determining, in case a connection request for connecting, via a base station relating to a first communication carrier, a first wireless communication device to a base station relating to a second communication carrier is received from the first wireless communication devices;

comparing connection information on a number of wireless communication devices connected to the base station, relating to the second communication carrier, to a threshold value;

determining permission or non-permission for the connection request based on the comparison result; and

setting authentication information to connect the base station relating to the second communication carrier to the first wireless communication device based on the determined permission;

extracting an identification of a wireless communication device of which a type of communication service relating to the connection request does not coincide with another type of communication service communicated between the base station relating to the second communication carrier after connection based on the set authentication information,

wherein, in the determination of the permission or non-permission, in case an identification of a wireless communication device, of which the types of the communication services do not coincide with each other, is extracted even if non-permission for the connection request is determined based on the comparison result, permission for the connection request is determined, and

wherein, in the setting, the authentication information to connect a base station with the lowest congestion degree to another base station relating to the authentication information set in the wireless communication device

corresponding to the extracted identification is set in the wireless communication device.

20. An information processing device comprising:

a determination unit configured to:

determine, in case a connection request for connecting, via a base station relating to a first communication operator, a first wireless communication device to a base station relating to a second communication operator is received from the first wireless communication device,

wherein the connection request comprising identification information of the base station relating to the second communication operator, and

determines, permission or non-permission for the connection request based on connection information on a number of wireless communication devices connected to the base station relating to the second communication operator,

wherein the connection request is a connection request for being connected to the base station with the lowest congestion degree among a plurality of base station to which the first wireless communication device is capable of being connected, and

wherein, in the determining of the permission or non-permission, in case the number of wireless communication devices connected to the base station relating to the second communication operator is equal to or greater is in a threshold value, a base station with the next lowest congestion degree to the base station relating to the second communication operator among the plurality of base station is set to a target base station, wherein in case the number of wireless communication devices connected to the target base station is lesser than the threshold, value, permission for connection to the target base station is determined; and

a control unit configured to control to set contract authentication information related to the second communication operator to connect the target base station to the first wireless communication device based on the determined permission.

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